The ELECTRICAL REVIEW

TRADE NAMES SUPPLEMENT

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THE "ELECTRICAL REVIEW" TRADE NAMES SUPPLEMENT.

Name and Description.	Manufactured by or Obtainable from.
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A.C.E.C. Cables, electrical machinery, transformers	A.C.E.C., 56, Victoria St., London, S.W.1.
ACME Automatic time switches, Goliath and Edison screw lamp holders, lanterns for street lighting	The "Acme" Lighting & Engineering Co., Waverley Rd., St. Albans, Herts.
ACME Motor starting switches	Acme Electrical Mfg. Co., Tariff Rd., N.17.
A.D. Primary cells	Le Carbone, Coventry House, South Place, E.C.2.
ADANAC Switch with fuses	Berry's Electric, Ltd., 85-86, Newman St., Oxford St., W.1.
ADAPTABLE Earthing clip	Hann & Ingle, 13, Albert Place, Bridge St., Manchester.
ADJUSTABLE Adaptor (two pin to B.C.)	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
ADNIL Press-button switches of "ebolite"	S. G. Leach & Co., Ltd., 26-30, Artillery Lane, E.1.
ADVANCE Flush and semi-recessed plug connectors	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
A.E.G. Electrical machinery, domestic appliances, meters of all kinds	A.E.G. Machinery & Apparatus Co., Ltd., 131, Victoria St., S.W.1.
AEROFLEX Rewirable cartridge fuses with high-rupturing capacity	Parmiter, Hope & Sugden, Ltd., Fluvent Electrical Works, Vernon St., Longsight, Manchester.
AIRMAX Inductance coils	J. Dyson & Co., Ltd., 5 & 7, Godwin St., Bradford.
AJAX Ultra-violet ray (artificial sunlight) lamps, Sunviray and all electro-medical and hairdressing trade apparatus	Ajax, Ltd., 117, Central St., E.C.1.
AJAX-NORTHRUP Electric furnace, high frequency for steel, nickel silver, copper, platinum, &c.	Electric Furnace Co., Ltd., 17, Victoria St., S.W.1.
AJAX-WYATT Electric furnace, induction type for brass melting	Electric Furnace Co., Ltd., 17, Victoria St., S.W.1.
AKK-EMMAR Rectifiers for battery charging, kinema projectors, X-ray apparatus and all other non-inductive circuits	Automatic Rectifiers, Ltd., 75, Sancroft St., Lambeth, S.E.11.
ALKLUM Batteries (nickel-steel type)	Worsnop & Co., Ltd., Carlton Works, Halifax.
ALLIGATOR Belt fasteners	J. B. Stone & Co., Ltd., 135, Finsbury Pavement, E.C.2.
ALTON Storage batteries	The Alton Battery Co., Ltd., Alton, Hants.
ANCALITE Electric cables	Callender's Cable & Construction Co., Ltd., Hamilton House, Victoria Embankment, E.C.4.
ANCHORA Wood poles for transmission	Armstrong, Addison & Co., 17, North Bridge St., Sunderland.
ANTI-SULPHURIC Enamel	Griffiths Bros. & Co., London, Ltd., Macks Rd., S.E.16.
APEX Switch and fusegear	Foster Engineering Co., Ltd., Morden Works, Wimbledon, S.W.19.
ARCOVITE Arc shields, mouldings, sheets and tubes	Siluminite Insulator Co., Ltd., Erith, Kent.
ARGENTA Lamps	Philips Lamps, Ltd., 145, Charing Cross Rd., W.C.2.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
ARLITA Internally frosted lamps	Philips Lamps, Ltd., Philips House, 145, Charing Cross Rd., W.C.2.
ARMACELL Insulating varnish	Griffiths Bros. & Co., London, Ltd., Macks Rd., S.E.16.
ARMORDUCT Wires, cables, and flexibles	Armorduct Cable Co., Ltd., 159, Westminster Bdge. Rd., S.E.
ARON Electricity meters, kVA and kW M.D.I.'s, time switches, taximeters, &c.	Aron Electricity Meter, Ltd., 80, Salusbury Rd., Kilburn, N.W.6.
ARORA Electric fires, electric kettles, electrical cooking apparatus, industrial electric heaters	Arora Co., Rosebery St., Loughborough.
ARPEECO Technical advertising service ...	Ripley, Preston & Co., Ltd., Queen's College, Birmingham.
ARROW The complete line of wiring devices, reciprocating heating switches, &c.	S. G. Leach & Co., Ltd., 26-30, Artillery Lane, E.1.
ARTIC Switchboards, electric light fittings, &c.	Artic Fuse & Electrical Manufacturing Co., Ltd., Birtley, Co. Durham.
ARTIC Pressure contact self-aligning fuses, distribution gear, feeder pillars	Artic Fuse & Electrical Manufacturing Co., Ltd., Birtley, Co. Durham.
ASEA Single, two- and three-phase a.c. motors and generators, direct current motors and dynamos, transformers	Asea Electric, Ltd., 5, Chancery Lane, W.C.2.
H. E. ASHDOWN (BIRMINGHAM), LTD. "Bakelite" mouldings and laminated stampings	H. E. Ashdown (Birmingham), Ltd., Perry Barr, Birmingham.
H. E. ASHDOWN (BIRMINGHAM), LTD. Electric lighting fittings (Bakelite) ...	H. E. Ashdown (Birmingham), Ltd., Perry Barr, Birmingham.
ATLAS Leclanché batteries	Atlas Carbon & Battery Co., Ltd., 56, Southwark Bridge Rd., S.E.1.
A.T.M. IN CIRCLE Telephone and telegraph equipment	Automatic Telephone Mfg. Co., Ltd., Strowger Works, Milton Rd., Edge Lane, Liverpool.
AUTO-COMBINATION Tumbler switch plugs	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
AUTONOFF Time switch	Venner Time Switches, Ltd., 45, Horseferry Rd., S.W.1.
AUTOREELITE Combined spot light, trouble light, and portable light for motor-cars	Benjamin Electric, Ltd., Brantwood Works, Tariff Rd., N.17.
AVERY Boiler scales, totalisers and coal weighers	W. & T. Avery, Ltd., Soho Foundry, Birmingham.
AVERY Water weighers, weighing machines, coal meters	W. & T. Avery, Ltd., Soho Foundry, Birmingham.
A.W.P. Electric arc welding supplies	Alloy Welding Processes, Ltd., 14-16, Church St., N.1.
BAA Accumulator acid	F. W. Berk & Co., Ltd., 106, Fenchurch St., E.C.3.
BAKELAQUE Insulating material	Attwater & Sons, Hopwood St. Mills, Preston.
BAKELITE Insulating varnish	Attwater & Sons, Hopwood St. Mills, Preston.
BAKELITE Mouldings and insulating material ...	The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.
BAKELITE Mouldings	M-L Magneto Syndicate, Ltd., Coventry.
BAKELITE Insulating materials	The Micanite & Insulators Co., Ltd., Empire Works, Blackhorse Lane, Walthamstow, E.17.
BAKELITE Mouldings and insulating materials	The Brownie Wireless Co., of Great Britain, Ltd., Nelson St. Works, Mornington Crescent, N.W.1.
BAKELITE Synthetic resins, cement, silent gear material, &c.	Bakelite, Ltd., 68, Victoria St., S.W.1.
BAKELITE Moulding materials, laminated sheets, varnishes, &c.	Bakelite, Ltd., 68, Victoria St., S.W.1.
BALLSOK Admiralty pattern insulating beads...	Lionel Robinson & Co., 3, Staple Inn, W.C.1.
BATTERSEA Carbon brushes	Morgan Crucible Co., Ltd., Battersea Works, Church Rd., S.W.11.
BATWIN Motors	Power Contracts, Ltd., 138, Southwark St., S.E.1.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
B.C.M./A.T.M. Telephone and telegraph equipment, electric domestic appliances, mine signalling apparatus	Automatic Telephone Mfg. Co., Ltd., Strowger Works, Milton Rd., Edge Lane, Liverpool.
B. & D. Electric drills	Gerrard & Co., Ltd., 15-19, Gt. Titchfield St., W.1.
BEACON Electric lamps	The Maybrook Elecl. Co., Ltd., 19-21, Wilson St., E.C.2.
BEANCO Switches	Baxendale & Co., Ltd., Miller St., Manchester.
BEANCO Dry cells	Baxendale & Co., Ltd., Miller St., Manchester.
BEANCO Lampholders	Baxendale & Co., Ltd., Miller St., Manchester.
B.E.C. Motors, starting gear, switchgear ...	British Electric Co., 25-29, Lower Rd., Rotherhithe, S.E.16.
BECOL Ebonite (made to Government specification)	British Ebonite Co., Ltd., Nightingale Rd., W.7.
BECOLATE High-temperature insulation material (made to Government specification)	British Ebonite Co., Ltd., Nightingale Rd., W.7.
B.E.L. Violet-ray high frequency and radiant heat apparatus	Bower Electric (1926), Ltd., 27, Ridinghouse St., Gt. Portland St., W.1.
B.E.L.L. Decorative and special lamps only for linolite reflectors, candelabra fittings, etc.	British Electric Lamps, Ltd., Spencer Hill Rd., S.W.19.
BELLEROID Insulators	Barrett & Elers, Ltd., Dace Rd., E.3.
B.E.M. Motors	Brittain's Electric Motor Co., Eastdown Works, Dermody Rd., Lewisham, S.E.13.
BENCO Heavy duty B.C. & E.S. lampholders	Benjamin Electric, Ltd., Brantwood Works, Tariff Rd., N.17.
BENCOLITE Ornamental glass lighting unit for commercial installations	Benjamin Electric, Ltd., Brantwood Works, Tariff Rd., N.17.
BENGRIP B.C. adaptors with special cord grip features	Benjamin Electric, Ltd., Brantwood Works, Tariff Rd., N.17.
BENJAMIN Reflectors, industrial signals, automobile accessories, wireless, &c.	Benjamin Electric, Ltd., Brantwood Works, Tariff Rd., N.17.
BENJAMIN CLEARER TONE Anti microphonic valve holders ...	Benjamin Electric, Ltd., Brantwood Works, Tariff Rd., N.17.
BERGMANN Fans, motors, cables	The Bergmann Electric Co., Ltd., 82, Victoria St., S.W.1.
BERLINER Automatic and telephone apparatus	Shipton Automatic Telephone System, Ltd., Caxton House, Tothill St., S.W.1.
BERRITE Insulating fabrics and varnishes, joint box and sealing compound	Berrite, Ltd., Yiewsley, Middlesex.
BERRY Transformers	British Electric Transformer Co., Ltd., Hayes, Middlesex.
BIBBY Couplings and air filters	Wellman Bibby & Co., Ltd., Victoria Station House, Victoria St., S.W.1.
BIFLECTOR Reflector fitting	Benjamin Electric, Ltd., Brantwood Works, Tariff Rd., N.17.
BIMETAL Non-oxidising, non-arcing fuse wire	Parmiter, Hope & Sugden, Ltd., Fluvent Electrical Works, Vernon St., Longsight, Manchester.
BLACKFRIARS Adhesive tape	Spicers, Ltd., 19, New Bridge St., E.C.4.
BLACKLEY Tape	Connolly's (Blackley), Ltd., Blackley, Manchester.
BLACO Al'-steel conduit fittings	F. C. Blackwell & Co., Ltd., Great Crosby Works, Liverpool.
BLAIZOLITE Adjustable patent projector lantern	Norrington & Landon, Ltd., 33, Brazennose St., Manchester.
BLAKE Insulated staples	Mosses & Mitchell, Ltd., 122-124, Golden Lane, E.C.1.
BLUE LABEL Dry cell	Standard Telephones & Cables, Ltd., Connaught House, Aldwych, W.C.2.
BOREAS Air compressors, vacuum pumps, pneumatic equipment	Lacy-Hulbert & Co., Ltd., Boreas Works, Beddington, Croydon.
BOTRADE Switches and distribution boards ...	S. Bill & Co., Ltd., Queen's Rd., Aston, Birmingham.
BOYCE MOTO-METER Radiator temperature indicator ...	Benjamin Electric, Ltd., Brantwood Works, Tariff Rd., N.17.
BRITMAC Tumbler switches, lampholders and electrical accessories	C. H. Parsons, Ltd., Britannia Works, Tyseley, Birmingham.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
BRITTAIN Motors	Brittain's Electric Motor Co., Eastdown Works, Dermody Rd., Lewisham, S.E.13.
BROOK COMPLETE Lamp lock for ordinary brass lamp-holders	J. A. Brook, 21, John William St., Huddersfield.
BROWN-BOVERI Automatic pressure regulators ...	British Brown Boveri, Ltd., Trafalgar House, Waterloo Place, S.W.1.
BROWNIE Wireless receivers and components...	The Brownie Wireless Co. of Gt. Britain, Ltd., Nelson St. Works, Mornington Crescent, N.W.1.
BRUSH Tramcars, tramcar trucks, motor-'bus bodies	The Brush Electrical Engineering Co., Ltd., Falcon Works, Loughborough.
BRUSH Transformers, motors and generators, liquid starters	The Brush Electrical Engineering Co., Ltd., Falcon Works, Loughborough.
BRUSH-LJUNGSTROM Steam turbo-generators	The Brush Electrical Engineering Co., Ltd., Falcon Works, Loughborough.
BRUSTON Electric lighting plants, pumps, and refrigerators	G. C. Pillinger & Co., 53, Victoria St., S.W.1.
B.T.H. Electrical equipment and radio apparatus	British Thomson-Houston Co., Ltd., Rugby.
BULL Motors and dynamos	Bull Motors, Ltd., Ipswich, England.
CABLEGRIP Cable boxes	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
CAB TYRE Cab tire sheathed wires and cables	St. Helens Cable & Rubber Co., Ltd., Slough.
CAB TYRE Electrical cables	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, London, E.C.1.
CAB TYRE Cab-tire sheathed wires and cables of all types	W. T. Glover & Co., Ltd., Trafford Park, Manchester.
CAB TYRE Cab-tyre sheathed cables and wires	Siemens Bros. & Co., Ltd., Woolwich, S.E.18.
CABTYRIT Corrosion-resisting rubber	St. Helens Cable & Rubber Co., Ltd., Slough.
CADURO Cadmium copper wire for trolley and transmission purposes	Richard Johnson & Nephew, Ltd., Bradford Iron Works, Manchester.
CALLENDER Electric cables of all types	Callender's Cable & Construction Co., Ltd., Hamilton House, Victoria Embankment, E.C.4.
CALORA Electric heating pads, foot-warming mats, &c.	M. E. du Bois & Co., 25, Redcross St., E.C.1.
CAMBRIDGE Instruments	Cambridge Instrument Co., Ltd., 45, Grosvenor Place, S.W.1.
CASTLE Dynamos and motors	J. H. Holmes & Co., Portland Rd., Newcastle-on-Tyne.
CECIL Resistances, fan regulators, dimmers	Mansell & Ogan, Ltd., 15-16, Floral St., Covent Garden, W.C.2.
CELEC Sliding resistances, dimmers, arc resistances, and charging boards	Curtis Mfg. Co., Ltd., Conduit Place, W.2.
CELERITY Rail grinders	Equipment & Engineering Co., 2 & 3, Norfolk St., W.C.2.
CENTURY Single-phase repulsion induction motors, two- and three-phase automatic start motors, fractional h.p. split phase motors	Asea Electric, Ltd., 5, Chancery Lane, W.C.2.
CENTURY D.c. volt-ammeter test set	Elliott Bros. (London), Ltd., Century Works, Lewisham, S.E.13.
C. & H. Electricity meters and instrument transformers	Chamberlain & Hookham, Ltd., Solar Works, New Bartholomew St., Birmingham.
C.H. Hand-operated and self-acting electric motor controlling apparatus and wireless components	Igranic Electric Co., Ltd., 149, Queen Victoria St., E.C.4.
CHANGE COIL Multi-range electrical testing set ...	Record Electrical Co., Ltd., Broadheath, Altrincham, Cheshire.
CHASLYN S.O.S. AND VENT TYPE Hydrometer with gravity balls ...	J. H. Collie & Co., 10, Canning Place, Liverpool.
CHLORIDE Storage batteries	The Chloride Electrical Storage Co., Ltd., Clifton Junction, near Manchester.
CHROMALOX Electric heating units	Geo. Bray & Co., Ltd., Leeds.
CIRSCALE Electrical measuring instruments ...	Record Electrical Co., Ltd., Broadheath, Altrincham, Cheshire.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
CITY Motors	City Electrical Co., 1, Emerald St., W.C.1.
CLARITONE Loudspeakers and headphones ...	Automatic Telephone Mfg. Co., Ltd., Milton Rd., Edge Lane, Liverpool.
CLASSIC Pulpit, desk, piano and organ fittings	The Lodge Fittings Co., Ltd., 57, Albert Rd., Aston, Birmingham.
CLEARER TONE Anti-microphonic valve holders ...	Benjamin Electric, Ltd., Brantwood Works, Tariff Rd., N.17.
COCUSITE Moulded bakelite material for accessories	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
COLEC A system of heating combining central heating with electricity for topping up	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
COLUMBIA Red label dry cell batteries	J. R. Morris, 15, Kingsway, W.C.2.
COLUMBUS Automatic staircase time-lag switches	Elkay Electrical Manufacturing Co., Ltd., 4, Southampton Row, W.C.1.
COOLEX ADJUSTA Fuseboards and ironclad switches ...	United Elec. Co. (Birmingham), Ltd., Coolex Works, Caroline St., Birmingham.
CORNWALL Regulators and dimmers	Donovan & Co., 47, Cornwall St., Birmingham.
COROX Insulating material	Westinghouse Elec. International Co., 2, Norfolk St., W.C.2.
COSMOS Cookers, domestic appliances, electric kitchen equipment, &c.	Metro-Vick Supplies, Ltd., 155, Charing Cross Rd., W.C.2.
COSMOS Lamps, fires, fans	Metro-Vick Supplies, Ltd., 155, Charing Cross Rd., W.C.2.
COSMOS Radiophones, radio valves and wireless apparatus	Metro-Vick Supplies, Ltd., 155, Charing Cross Rd., W.C.2.
COXPAR Voltage regulator	Cox-Walker & Partners, Darlington.
CRABTREE Accessories and switchgear	J. A. Crabtree & Co., Ltd., Lincoln Works, Walsall.
CRACORE Twin and three-core solid bitumen cables, cab tire sheathed trailing cables	W. T. Glover & Co., Ltd., Trafford Park, Manchester.
CRANE WITH ELECTRIC SYMBOL (DESIGN) Electric cranes, &c.	S. H. Heywood & Co., Ltd., Reddish, Stockport.
CREDA Heating and cooking appliances ...	Credenda Conduits Co., Ltd., Oldbury, Birmingham.
CRESSALL Resistance nets, regulators, unit heaters	Cressall Mfg. Co., Eclipse Works, 31 & 32, Tower Street, Birmingham.
CROWN Cables, black adhesive and rubber tapes and flexibles	Foster Engineering Co., Ltd., Morden Works, Wimbledon, S.W.19.
CROYDON Searchlight projectors	London Electric Firm, Brighton Rd., South Croydon.
CROYDON Portable household electric vacuum cleaner	Croydon Engg. Co., Ltd., Victory Works, Gloucester Rd., Croydon.
CRYPTO Generators and motors (a.c. and d.c.), constant potential equipments, commutating rectifiers, cinema arc sets, &c.	The Crypto Electrical Co., Ltd., Acton Lane, Willesden, London, N.W.10, associated with The Lancashire Dynamo and Motor Co., Ltd., Trafford Park, Manchester.
CRYSELCO Electric lamps	Cryselco, Ltd., Kempston Works, Bedford.
C.T.S. Cab tyre sheathed cables	St. Helens Cable & Rubber Co., Ltd., Slough.
C.T.S. Electrical cables	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
C.T.S. Cab-tyre sheathed wires and cables of all types	W. T. Glover & Co., Ltd., Trafford Park, Manchester.
C.T.S. Cab-tyre sheathed cables	Siemens Bros. & Co., Ltd., Woolwich, S.E.18.
CUMULUS Electric water heaters	Nathan & Allen, Ltd., 25, Victoria St., London, S.W.1.
DAMARDA Lacquer	Bakelite, Ltd., 68, Victoria St., S.W.1.
DANIA Dry cells	Atlas Carbon & Battery Co., Ltd., 56, Southwark Bridge Rd., S.E.1.
DECO Patent limit switches, cable reeling drums, and special control devices for handling plants	Dalyte Electrical Co., Deco Engg. Works, West Row, N. Kensington, W.10.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
DELTA Bell batteries	Falk, Stadelmann & Co., Ltd., Efesca Electrical Works, 83-93, Farringdon Rd., E.C.1.
DERI Motors, single and multi-phase, variable speed	British Brown Boveri, Ltd., Trafalgar House, Waterloo Place, S.W.1.
DESCO Fuses, distribution gear and switchboards	G. P. Dennis, Ltd., 66, South John St., Liverpool.
DIALITE Electric cables	St. Helens Cable & Rubber Co., Ltd., Slough.
DIAMOND Seal padlocks for slot meters	The Tourtel Mfg. Co., 48, Uxbridge Rd., Ealing, W.5.
DIAMOND H Switches all types, temperature control apparatus	Hart Manufacturing Co., 76-76b, Rochester Row, S.W.1.
DIATRINE Diatrine paper-insulated cable ...	W. T. Glover & Co., Ltd., Trafford Park, Manchester.
DICTOGRAPH House and office telephones	Dictograph Telephones, Ltd., Aurelia Rd., Croydon.
DIM-A-LAMP Portable lamp with dimming device	Benjamin Electric, Ltd., Brantwood Works, Tariff Rd., N.17.
DIM-A LITE Adaptor lampholder with dimming device	Benjamin Electric, Ltd., Brantwood Works, Tariff Rd., N.17.
DIX-ONEMETER Multi-range portable testing meter for current and volts with interchangeable multipliers	Leslie Dixon & Co., 218, Upper Thames St., E.C.4.
DOT Two-pin plug connectors and switch plugs	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
DOWSING'S Electric heating and medical appliances	Dowsing Radiant Heat Co., Ltd., Bollo Lane, Acton, W.3, and 91-3, Baker St., W.1.
D.P. Storage batteries	The D.P. Battery Co., Ltd., Bakewell, Derbyshire.
DRAKA Cables	Electric Cables, Ltd., 88, Golden Lane, E.C.1.
DUFLEX Control of pendulums in existing turret clocks	Gent & Co., Ltd., Faraday Works, Leicester.
DUNDEE Tapes	William Geipel, Ltd., Vulcan Works, 156-170, Bermondsey St., S.E.1.
DUO-SAVELITE Double filament lamp	Philips Lamps, Ltd., 145, Charing Cross Rd., W.C.2.
DUPLEX Two-way tumbler switch with "off" position	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
DUREX Electric wiring system for C.T.S. or L.C. cables	Simplex Conduits, Ltd., Garrison Lane, Birmingham.
E Control gear, &c.	Geo. Ellison, Perry Barr, Birmingham.
EARTHING CLIPS Copper earthing clips, patent anti-vibration earth clips and adjustable earth clips	The Earthing Clip Co., 71, Hatherly St., Princes Rd., Liverpool.
EBBINITA Mouldings (not fireproof)	Siluminite Insulator Co., Ltd., Erith, Kent.
EBOLITE Insulated switches of moulded composition	S. G. Leach & Co., Ltd., 26-30, Artillery Lane, E.1.
EDISWAN Dry batteries	The Edison Swan Electric Co., Ltd., 123-5, Queen Victoria St., E.C.4.
EDISWAN Valves	The Edison Swan Electric Co., Ltd., 123-5, Queen Victoria St., E.C.4.
EDISWAN HYMEG H.T. accumulators	The Edison Swan Electric Co., Ltd., 123-5, Queen Victoria St., E.C.4.
EDISWAN LOTEN L.T. accumulators	The Edison Swan Electric Co., Ltd., 123-5, Queen Victoria St., E.C.4.
EDISWAN R.C. THREESOME 3-valve constructor's set	The Edison Swan Electric Co., Ltd., 123-5, Queen Victoria St., E.C.4.
E. & E. Railway and tramway specialities ...	Equipment & Engineering Co., 2 & 3, Norfolk St., W.C.2.
EELEX Small wireless and electrical components and accessories	J. J. Eastick & Sons, 118, Bunhill Row, E.C.1.
EFCO Resistance furnace, Wild-Barfield and non-metallic resistor types	Electric Furnace Co., Ltd., 17, Victoria St., S.W.1.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
EFESCA Switches, batteries, lampholders ...	Falk, Stadelmann & Co., Ltd., Efesca Electrical Works, 83-93, Farringdon Road, E.C.1.
ELASTRONG Mechanical rubber	St. Helens Cable & Rubber Co., Ltd., Slough.
ELASTUMEN Cable	Johnson & Phillips, Ltd., Charlton, S.E.
ELECT Cooking and heating apparatus, ovens irons, fires, &c.	The Electric Heating Co., George St., Croydon.
ELECTRICFLAME Fires	The Electric Heating Co., George St., Croydon.
ELECTRICFURN Electric furnaces for melting and heating	Stobie Steel Co., Ltd., Dunston-on-Tyne.
ELECTRICOAL (HEATRAE) Imitation coal fires	Electric Fires, Ltd., Heatrae Works, Norwich.
ELECTRIC TRANSMISSION Transmission line accessories, bushings, pole top switchgear	Electric Transmission, Ltd., Culford Works, Kingsbury Rd., Dalston, N.1.
ELECTROART Hand painted, parchment, vellum and fabricette lampshades	Electric Art Shades (1928), Witham, Essex.
ELECTROFLO Industrial instruments	Electroflo Meters Co., Ltd., Abbey Rd., Park Royal, N.W.10.
ELECTRO-VAPOUR Radiators	Benham & Sons, Ltd., 66, Wigmore St., W.1.
ELEPHANTIDE Insulating pressboards	B. S. & W. Whiteley, Ltd., Pool, Nr. Leeds.
ELGEE Electricity meters, time switches, and instrument transformers	Landis & Gyr, Ltd., Elgee Works, Victoria Rd., North Acton, W.3.
ELIMINAIR Feed water deaerator	Richardsons, Westgarth & Co., Ltd., Hartlepool.
ELIXUM Quick make and break switch and fuse, ironclad fuses	Sykes & Dyson, Ltd., Queen's Mill Rd., Huddersfield.
ELLIOTT Electrical measuring instruments of all kinds	Elliott Bros. (London), Ltd., Century Works, Lewisham, S.E.13.
ELLISON Circuit breakers, electric	Geo. Ellison, Perry Barr, Birmingham.
ELLISON Plastic insulating compound, formerly known as "Plastol"	Geo. Ellison, Perry Barr, Birmingham.
ELLMAR Moulded pressings in bakelite and similar materials, insulating parts, &c.	The Ellmar Mouldings Co., Thimble Mill Lane, Birmingham.
EMPIRE Insulating cloth and tape	Attwater & Sons, Hopwood Street Mills, Preston.
EMPIRE Insulating cloths, tapes, silks, papers and tubes	The Micanite & Insulators Co., Ltd., Empire Works, Blackhorse Lane, Walthamstow, E.17.
EMPIRE Automatic controllers, high tension fuses, overhead h.t. line equipment	Electric Control, Ltd., "Empire" Works, Bridgeton, Glasgow.
EMVEE Lampholders, switches and general accessories	Metro-Vick Supplies, Ltd., 155, Charing Cross Rd., W.C.2.
ENA Electric fires, electric heating elements	Ena Electrical Appliances, Ltd., 62, Englefield Rd., N.1.
ENDOLAC High grade black spirit insulating varnish for finishing coat on armatures and fields	Pinchin, Johnson & Co., Ltd., General Bldgs., Aldwych, W.C.2.
ENDURAL Special cables and compound	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
ENFIELD Cables	The Enfield Cable Works, Ltd., Lincoln House, 292-302, High Holborn, W.C.1.
ENSIGN Lampholders and wall plugs	The General Accessories Co., Ltd., "Genex" House, 18-22, Euston Buildings, N.W.1.
E.P.S. Accumulators	Pritchett & Gold & E.P.S. Co., Ltd., 50, Grosvenor Gdns., S.W.1.
EQUATORIAL Cable	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
EQUILUXO A special type of glassware	The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.
ERICSSON Telephones and wireless apparatus ...	Ericsson Telephones, Ltd., 67-73, Kingsway, W.C.
"E.S." (monogram) Edison Swan products	Edison Swan Electric Co., Ltd., 123-5, Queen Victoria St., E.C.4.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
ESLA Street lighting equipment	Electric Street Lighting Apparatus Co., The Foundry, Canterbury.
ESSELL Insulating varnished cloth, papers, tapes, &c.	Spicers, Ltd., 19, New Bridge St., E.C.4.
EVER READY Dry cells, batteries, and electric lamps (portable)	Ever Ready Co. (Gt. Britain), Ltd., Hercules Place, N.7.
EVERAY High frequency, violet ray apparatus	I. Calvete, Ltd., 11, Little Saint Andrew St., St. Martin's Lane, W.C.2
EXALT Flat switches	The General Accessories Co., Ltd., "Genex" House, 18-22, Euston Buildings, N.W.1.
EXAUTO Time switch	Venner Time Switches, Ltd., 45, Horseferry Rd., S.W.1.
EXCELLO Arc lamps	Korting & Mathiesen Electrical Co., Ltd., 711 & 715, Fulham Rd, S.W.6.
EXIDE Storage batteries	The Chloride Electrical Storage Co., Ltd., Clifton Junction, near Manchester.
EXIDE-IRONCLAD Storage batteries	The Chloride Electrical Storage Co., Ltd., Clifton Junction, near Manchester.
EXOTHERM Welding machines and electrodes ...	The British Secheron Co., Ltd., 525, Abbey House, Westminster, S.W.1.
EXPOMETER Exposure meters for automatically controlling ultra violet ray apparatus	Bower Electric (1926), Ltd., 27, Ridinghouse St., Gt. Portland St., W.1.
EXPRESO (Pat.) Flat switches, quick make and break	The General Accessories Co., Ltd., 125, High Holborn, London, W.C.1.
FABROIL Non-metallic gears	British Thomson-Houston Co., Ltd., Rugby.
FAIRYLAND Lighting strip	Imperial Lighting Co. (Implitico), Ltd., 2-6, Pocock St., S.E.1.
F.A.P. Conduit and fittings and accessories	Fitter & Poulton, Ltd., Vincent Parade, Balsall Heath, Birmingham.
FARRINGDON Bells	Falk, Stadelmann & Co., Ltd., Efesca Electrical Works, 83-93, Farringdon Rd., E.C.1.
FIBRE Insulating materials	Mosses & Mitchell, Ltd., 122-124, Golden Lane, E.C.1.
FIBRESTOS Fireproof sheets	Siluminite Insulator Co., Ltd., Erith, Kent.
F.I.L. High tension suspension insulators...	William Geipel, Ltd., Vulcan Works, 156-170, Bermondsey St., S.E.1.
FIRIMINE Fuse switches	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
FISH-SPINE Admiralty-pattern insulating beads	Taylor, Tunnicliff (Refractories), Ltd., 110, Cannon St., E.C.4.
FLAMINGO Electric fires	British Electric Transformer Co., Ltd., Wellington House, 125-130, Strand, W.C.2.
FLEXOTUBE Insulated sleeving	John MacLennan & Co., 115, Newgate St., E.C.1.
FLEXTOL Power driven hand tools	S. H. Morden & Co., Ltd., Morden House, 18, Dartmouth St., S.W.1.
FLUVENT Distribution fuse boxes	Parmiter, Hope & Sugden, Ltd., Fluvent Electrical Works, Vernon St., Longsight, Manchester.
FLY Magicoal fire	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
FORMAPEX Insulating varnish, moulding mixtures, miocarta sheet and tubes	Ioco Rubber & Waterproofing Co., Ltd., Netherton Works, Anniesland, Glasgow, W.3.
FORMITE Bakelite moulding materials	Bakelite, Ltd., 68, Victoria St., S.W.1.
FOSTER Transformers, tanks, &c.	Foster Engineering Co., Ltd., Morden Works, Wimbledon, S.W.19.
FOSTER Lanterns and electric accessories ...	Foster Engineering Co., Ltd., Morden Works, Wimbledon, S.W.19.
F.R.—B'HAM Copper earth clips and other accessories	F. Ryman, 116, Livery St., Birmingham.
FRANCIS Lamp lock	Francis Lamp Locks, Ltd., 83, Pall Mall, S.W.1.
FREDENNIS Telephone and telegraph wires, cables, insulators and accessories	W. F. Dennis & Co., 70, Queen Victoria St., E.C.4.
FRIGID Fans of all types and sizes	Electroservice, Ltd., 3, Waterloo Road, S.E.1.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
FULLER Storage batteries, primary batteries, loud speakers and trickle chargers	Fuller Accumulator Co. (1926), Ltd., Woodland Works, Chadwell Heath, Essex, London, E.
FULLER Transformers, single, two- and three-phase induction motors, motor starters	Fuller Elecl. & Mnfg. Co., Ltd., 5, Chancery Lane, W.C.2.
FULLOLITE Lamps	Edison Swan Electric Co., Ltd., 123-5, Queen Victoria St., E.C.4.
FURSE Cinema curtain controllers and dimmers, organ and orchestra lifts	W. J. Furse & Co., Ltd., Traffic St., Nottingham.
GAMEWELL Fire alarm systems	Standard Telephones and Cables, Ltd., Connaught House, Aldwych, W.C.2.
GARDY Rotary switches and fuses	Thompson & Co., 1 & 3, Old Swan Lane, E.C.4.
GEAR SHIELD Gear-saving lubricant	Fred. J. Down, 90-93, Fenchurch St., E.C.3.
GECOFIX Electric light fittings of every description	The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.
GECORAY Reflectors for shop-window lighting	The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.
GENACCO Electric lighting accessories	The General Accessories Co., Ltd., 125, High Holborn, London, W.C.1.
GENEX Electric lighting accessories	The General Accessories Co., Ltd., "Genex" House, 18-22, Euston Buildings, N.W.1.
GENII Geysers, water heaters, stills, radiators, thermostats, &c.	Geo. Nobbs, Ltd., 89, Cleveland St., Fitzroy Sq., W.1.
GILSONITE Asphaltum, bitumen	Ashby, Morris, Ltd., 17, Laurence Pountney Lane, E.C.4.
GLASGOW-REX Ironclad switches	Midland Electric Mfg. Co., Ltd., M.E.M. Works, Barford St., Birmingham.
GLIMALAC For making up mica plates or material commonly called micanite	Pinchin, Johnson & Co., Ltd., General Bldgs., Aldwych, W.C.2.
GLOBAR Non-metallic electric heating elements	British Resistor Co., Ltd., 32, Clare Rd., Halifax, England.
GLO-CLAD Watertight and gastight electric lighting system	W. T. Glover & Co., Ltd., Trafford Park, Manchester.
GLOVERITE Insulated wires and cables for signalling and special situations	W. T. Glover & Co., Ltd., Trafford Park, Manchester.
GLOVERS Electric wires, cables and lead rubber-covered house wiring systems	W. T. Glover & Co., Ltd., Trafford Park, Manchester.
GLOVOX Compound insulated mains cables ...	W. T. Glover & Co., Ltd., Trafford Park, Manchester.
GOBLIN Electric suction cleaner	British Vacuum Cleaner & Engineering Co., Ltd., Parsons Green Lane, S.W.6.
GODWINEX Radio and electrical apparatus ...	J. Dyson & Co., Ltd., 5 & 7, Godwin St., Bradford.
GRAHAM Naval telephones, band repeater and docking order equipment	Alfred Graham & Co., Ltd., St. Andrew's Works, Slough, Bucks.
GRIPTITE Adhesive tape	Spicers, Ltd., 19, New Bridge St., E.C.4.
HÆTANIC Nickel chrome high resistance wire	L.P.S. Electrical Co., Ltd., Avenue Rd., Acton, W.3.
HAILGLASS Glassware	Hailwood & Ackroyd, Ltd., Beacon Works, Morley, Nr. Leeds.
HAMILTON BEACH Vacuum cleaners and other domestic appliances	S. G. Leach & Co., Ltd., 26-30, Artillery Lane, E.1.
HARCOURT Artistic electric light fittings, door furniture and switch plates	Metro-Vick Supplies, Ltd., 145, Charing Cross Rd., W.C.2.
HARPOON Guy anchors for staying poles, &c. ...	Fred. J. Down, 90-93, Fenchurch St., E.C.3.
HART Electrical accumulators	Hart Accumulator Co., Ltd., Marshgate Lane, E.15.
HAZEMEYER Switchgear, &c.	Alan Wright, 124, Chancery Lane, W.C.2.
HEATRAE Oil heaters, small cookers, hot pipes	Electric Fires, Ltd., Heatrae Works, Norwich.
HEATRAE Electric fires, immersion heaters, water heaters	Electric Fires, Ltd., Heatrae Works, Norwich.
H.E.C. Static transformers	Hackbridge Electric Construction Co., Ltd., Hersham, Walton-on-Thames.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
H.E.K. Cables and fittings of all descriptions, glassware, wireless sets	H. E. Kettle, Ltd., St. Peters Street, Maidstone.
HELENITE Electric cables	St. Helens Cable & Rubber Co., Ltd., Slough.
HELSBY Condensers for telephone, telegraph and power factor improvement	British Insulated Cables, Ltd., Helsby, near Warrington.
HELSBY Cords (telephone and switchboard) ...	British Insulated Cables, Ltd., Helsby, near Warrington.
HELSBY Rubber-insulated cables	British Insulated Cables, Ltd., Helsby, near Warrington.
HELSBY Wiring systems	British Insulated Cables, Ltd., Helsby, near Warrington.
HENDON Lamps, domestic utilities, &c. ...	The Hendon Elec. Lamp Co., Ltd., 104, Southampton Row, W.C.1.
HENLEX Special compound insulation	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
HENLEY Link disconnecting boxes	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
HENLEY Distribution pillars	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
HENLEY Tape	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
HENLEY Cables of all types	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
HENLEY Joint box compounds	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
HENLEY Plywood backboards	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
HENLEY WIRING SYSTEM Special wiring system and fittings ...	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
HERCULENE Electric cables	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
HEROULT Electric furnace, arc type for steel and nickel melting	Electric Furnace Co., Ltd., 17, Victoria St., S.W.1.
HINGELESS Fuseboard (non-corrodible, detachable)	S. Bill & Co., Ltd., Queen's Rd., Aston, Birmingham.
HITEST Cables	Falk, Stadelmann & Co., Ltd., Efesca Electrical Works, 83-93, Farringdon Rd., E.C.1.
HOFFMANN Ball and roller bearings, steel balls and rollers	Hoffmann Mfg. Co., Ltd., Chelmsford, Essex.
HOME OFFICE Lamp lock for H.O. type lampholders	J. A. Brook, 24, John William St., Huddersfield.
HOPKINSON OR H.I.M. Alternating-current motors	Hopkinson Induction Motors, Park Royal Rd., North Acton, W.3.
HOT-POINT Electric irons, soldering irons and branders	Dowsing Radiant Heat Co., Ltd., Bollo Lane, Acton, W.3, and 91-3, Baker St., W.1.
HOTPOINT Domestic electric appliances	Hotpoint Electric Appliance Co., Ltd., 24, Newman St., Oxford St., W.1.
HOTPOINT-FALCO Electric cookers	Hotpoint Electric Appliance Co., Ltd., 24, Newman St., Oxford St., W.1.
H.W.S. Special wiring system and fittings ...	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
HYPER-SCALE Electrical measuring instruments ...	Nalder Bros. & Thompson, Ltd., 97a, Dalston Lane, E.8.
ICALL Electro-medical apparatus, electrical equipment for hairdressers	I. Calvete, Ltd., 11, Little Saint Andrew St., St. Martin's Lane, W.C.2.
IDEAL Electrical measuring instruments and relays of all types	Nalder Bros. & Thompson, Ltd., 97a, Dalston Lane, E.8.
I. & F. Controller fingers, contacts and colliery coal-cutter spares and renewals	Imeson & Finch, "Empress" Works, Stockton-on-Tees.
IGRANIC All types of electric motor starting and motor controlling apparatus and wireless components	Igranic Electric Co., Ltd., 149, Queen Victoria St., E.C.4.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
IGRANIC-PACENT Radio components for wireless receiving sets	Igranic Electric Co., Ltd., 149, Queen Victoria St., E.C.4.
IMP Flat tumbler switches and switch plugs	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
IMPERIAL Conduit tubes and accessories ...	Isaac Griffiths & Sons, Imperial Works, Wednesbury, Staffs.
IMPERIAL Electric stage equipment	Imperial Lighting Co. (Implitico), Ltd., 2-6, Pocock St., S.E.1.
IMPREGNITE Black, solid, impregnating compound for treating all types of coils having a great depth of wire	Pinchin, Johnson & Co., Ltd., General Bldgs., Aldwych, W.C.2.
INDESTRUCTIBLE Non-pitting or burning starting and control gear	The Scottish Electric Co., Ltd., "Guildhall Works," Erskine St., Dundee.
INKWELL Recording instruments	Everett, Edgcumbe & Co., Ltd., Colindale Works, Hendon, N.W.9.
INTERMEDIATE Tumbler switch for control of lamps from more than two positions	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
INTERNATIONAL ELECTRIC CO., LTD. Automatic telephones, intercommunicating telephones, loudspeakers, &c.	International Electric Co., Ltd., 161a-166, Strand, W.C.2.
INVENTUM Fires, cookers, water heating and domestic appliances	Alan Wright, 124, Chancery Lane, W.C.2.
INVENTUM Electric fires, electric water taps, electric cisterns	W. C. Yuille & Co., Ltd., 155a, St. Vincent St., Glasgow, C.2.
INVENTUM Electric fires, water heating and cooking appliances	Inventum Electrical Appliances, Sales Dept., 124, Chancery Lane, W.C.2. (Alan Wright, Sole Agent Gt. Britain and Colonies.)
IRONSAFE Switchboards	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
ISCO Ironclad service cutouts	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
ISOLAC An acid and waterproof, air drying and baking insulating varnish of high electrical resistance, and permanent plasticity	Pinchin, Johnson & Co., Ltd., General Bldgs., Aldwych, W.C.2.
JACELITE Moulded accessories	J. A. Crabtree & Co., Ltd., Lincoln Works, Walsall.
JACKSON Electric cookers, fires, kettles, breakfast cookers, &c.	The Jackson Electric Stove Co., Ltd., 143, Sloane St., S.W.1.
J.K.W. Solid contact lampholders	J.K.W. Manufacturing Co., Ltd., Bridge Works, Warrenby, Redcar, Yorks.
J.L. Universal wiring clips	Walter Balmford, M.I.E.S., "Electric House," 116, Steelhouse Lane, Birmingham.
J. & P. Wiring system	Johnson & Phillips, Ltd., Charlton, S.E.
JUBILEE Worm-drive earthing clips	L. Robinson & Co., "London Chambers," Gillingham, Kent.
KALANITE Insulating material	Callender's Cable & Construction Co., Ltd., Hamilton House, Victoria Embankment, E.C.4.
KALANOID Plastic waterproof compound	Callender's Cable & Construction Co., Ltd., Hamilton House, Victoria Embankment, E.C.4.
KALECORE Electric cables	Callender's Cable & Construction Co., Ltd., Hamilton House, Victoria Embankment, E.C.4.
KALEECO Electric wiring system	Callender's Cable & Construction Co., Ltd., Hamilton House, Victoria Embankment, E.C.4.
KALIBOND Lead-sheathed cable having special bonding wire	Callender's Cable & Construction Co., Ltd., Hamilton House, Victoria Embankment, E.C.4.
KANDEM Lighting fittings, electricity meters and arc lamps for all purposes	Korting & Mathiesen Electrical, Ltd., 711 and 715, Fulham Rd., S.W.6.
KANGAROO Electric radiator	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
KANTARK Fuses, cut-outs and distribution boards	Midland Electric Mfg. Co., Ltd., M.E.M. Works, Barford St., Birmingham.
KATHANODE Storage batteries	The D.P. Battery Co., Ltd., Bakewell, Derbyshire.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
KAYBEE Wash boiler	Armature Winding Co., Ltd., Castle Grounds, Bury, Lancs.
KEY FIBRE CONDUIT Conduit for underground cables and bird guards	Key Engineering Co., Ltd., 4, Queen Victoria St., E.C.4.
KILARC Positive action quick make and break tumbler switches	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7
KINARKO Carbons for cinematograph work, &c.	The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.
KINGOLITE Electric candles	Edison Swan Electric Co., Ltd., 123-5, Queen Victoria St., E.C.4.
KINGSWAY Combined switch and plug	The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.
KLIP-LAMPLOK Lamp lock for Bakelite lampholders	J. A. Brook, 24, John William St., Huddersfield.
KLYMAX Single and two-way narrow-panel tumbler switches	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
KOMET Electric heating appliances	Electric Heating & Hardware, Ltd., Crown Works, Berkley St., Birmingham.
KONE Loud speaker	Standard Telephones & Cables, Ltd., Connaught House, Aldwych, W.C.2.
KONFORM Switch plug	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
LANCASHIRE Generators and motors, synchronous motors, turbo-alternators, &c.	Lancashire Dynamo & Motor Co., Ltd., Trafford Park, Manchester, associated with The Crypto Electrical Co., Ltd., Acton Lane, Willesden, N.W.10.
LATASCALE Indicating instruments	Elliott Bros. (London), Ltd., Century Works, Lewisham, S.E.13.
LAURIE & INGLEFIELD Travelling lights and stretching pendants	Thos. Laurie & Co., Ltd., West End, Falkirk.
LEATHEROID Insulating materials	Mosses & Mitchell, Ltd., 122-124, Golden Lane, E.C.1.
LEATHEROID Insulating materials	Attwater & Sons, Hopwood St. Mills, Preston.
LEATHEROID Insulating materials	The Micanite & Insulators Co., Ltd., Empire Works, Blackhorse Lane, Walthamstow, E.17.
L.E.C. Switchgear, conduits, cables and wireless accessories	The London Electrical Co., 1, Sherborne Lane, E.C.4.
LECITE (Regd.) CABLES Wires and cables	The Liverpool Electric Cable Co., Ltd., Linacre Lane, Bootle, Liverpool.
LEKTRIK Switches, plug connectors and kindred accessories	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
LEW Wires and cables	The London Electric Wire Co. & Smiths, Ltd., Playhouse Yard, Golden Lane, E.C.1.
LEWCOS Radio products	The London Electric Wire Co. & Smiths, Ltd., Playhouse Yard, Golden Lane, E.C.1.
LINAPEX Varnished cloths, silks and tapes ...	Ioco Rubber & Waterproofing Co., Ltd., Netherton Works, Anniesland, Glasgow, W.3.
LINK Clips for fixing metal sheathed house wires	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
LINOLITE Reflector fittings for shop-window, cornice and picture lighting	A. W. Beuttell, Ltd., 96, Victoria St., S.W.1.
LITHOLITE Moulded insulators	Litholite Insulators, Ltd., 55-57, Hackney Grove, London, E.8.
LITTLE GIANT Electric and pneumatic portable hand drills	The Consolidated Pneumatic Tool Co., Ltd., Egyptian House, 170, Piccadilly, W.1.
LIVERPOOL CABLES Wires and cables	The Liverpool Electric Cable Co., Ltd., Linacre Lane, Bootle, Liverpool.
L.K. House service meters, overhead line switchgear, lighting accessories	Elkay Electrical Mfg. Co., Ltd., 4, Southampton Row, W.C.1.
LOHYS Electrical sheets and stampings ...	Joseph Sankey & Sons, Ltd., Bilston, Staffs.
LORIVAL Insulating material	Lorival Mfg. Co. (1921), Ltd., Norwood Works, Southall, Middlesex.
L.P. Lamplock	G. S. Peckham & Co., 4-5, New Compton St., Charing Cross Rd., W.C.2.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
L.P.S. Insulated varnished silk cambric, paper, tapes and sleevings, bakelite, &c.	L.P.S. Electrical Co., Ltd., Avenue Rd., Acton, W.3.
L.P.S. Magnet and resistance wires, cords and tungsten contacts	L.P.S. Electrical Co., Ltd., Avenue Rd., Acton, W.3.
L.P.S.-DUDLO Enamelled wire	L.P.S. Electrical Co., Ltd., Avenue Rd., Acton, W.3.
L.S.A. Batteries	Thompson & Co., 1 & 3, Old Swan Lane, E.C.4.
LUNDBERG Switches, plug connectors and kindred accessories	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
LUX Storage batteries	Chloride Electrical Storage Co., Ltd., Clifton Junction, near Manchester.
LUX Dry gas fire extinguishing without damage	Walter Kidde & Co., Inc., 2, Victoria St., S.W.1.
LUXRAY Glassware lighting units	Downes & Davies, 1 & 3, Stanley St., Liverpool.
LYRIC Fittings wire	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
M. & C. Open type switch and control gear, ironclad switch and control gear, flameproof switch and control gear	Mavor & Coulson, Ltd., 47, Broad St., Mile End, Glasgow.
MACINTOSH Paper and rubber insulated cables ...	Macintosh Cable Co., Ltd., St. James's House, St. James's St., S.W.1.
MACINTOSH Wiring systems	Macintosh Cable Co., Ltd., St. James's House, St. James's St., S.W.1.
MACONITE Insulated cables	Macintosh Cable Co., Ltd., St. James's House, St. James's St., S.W.1.
MACRORY Service box	Standard Telephones & Cables, Ltd., Connaught House, Aldwych, W.C.2.
MAGICLOG Electric log fires	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
MAGICOAL Electric fires	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
MAGNA V.i.r. cables and lead covered cables, &c.	Magna Wire & Cable Co., Ltd., 137, Victoria St., S.W.1.
MAGNASTART High starting torque S.C. motors ...	The Harland Engineering Co., "B.E.P." Works, Alloa, Scotland.
MAGNET Electric fans of every description ...	The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.
MAGNET Household electric appliances for heating, cooking, washing, cleaning, ironing, &c.	The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.
MAGNET Wiring systems for general and industrial purposes	The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.
MAGNET Conduits, fittings and accessories ...	The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.
MAGNUM Two-pin plug connectors	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
MAJESTIC Wireless h.t. battery eliminator ...	The Benjamin Electric, Ltd., Brantwood Works, Tariff Rd., Tottenham, N.17.
MANSON Adhesive protecting tape	William Geipel, Ltd., Vulcan Works, 156-170, Bermondsey St., S.E.1.
MARCONI Various types of valves for reception and transmission, bright and dull emitter for both general and special purposes	M.O. Valve Co., Ltd., Osram Works, Brook Green, Hammersmith.
MARELLI Electric fans	Marelli & Co., Ltd., 19-20, Garlick Hill, E.C.
MARTINS A.P. double-pole porcelain fuses ...	W. C. Martin & Co., Ltd., 12, West Campbell St., Glasgow.
MARVEL Tumbler switches for variable control from two or more positions	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
MASTA Ironclad fuse-switches	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
THE MASTER VALVE Wireless receiving, transmitting, rectifying and modulating valves	Mullard Radio Valve Co., Ltd., Nightingale Works, Nightingale Lane, S.W.12 (Manufacturers). Mullard Wireless Service Co., Ltd., Mullard House, Denmark St., W.C.2 (Distributors).
MAXEI Vacuum impregnating plant, coil and armature winding machines, transformer de-hydrating apparatus (vacuum and centrifugal)	Soc. Anon. Machines Auxiliares Pour l'Electricité & l'Industrie, 66, Victoria St., S.W.1.
MAXIGRAPH Chart recording maximum demand instruments	Landis & Gyr, Ltd., Elgee Works, Victoria Rd., North Acton, W.3.
MAXIM Lamps	Poynter, Griffiths & Co., Ltd., Maxim Lamp Works, 75, Canonbury Rd., N.1.
MAXLUME Industrial and commercial lighting fittings and heating apparatus	Veritys, Ltd., Plume Works, Aston, Birmingham.
MAXTORQ Squirrel-cage type induction motors (single, two and three speed type)	Lancashire Dynamo & Motor Co., Ltd., Trafford Park, Manchester, associated with The Crypto Electrical Co., Ltd., Acton Lane, Willesden, London, N.W.10.
MAYTAG Electric clothes washer	Hotpoint Electric Appliance Co., Ltd., 24, Newman St., Oxford St., W.1.
MAZDA Lamps and valves	The British Thomson-Houston Co., Ltd., Crown House, Aldwych, W.C.2.
MAZDALUX Industrial lighting reflectors	The British Thomson-Houston Co., Ltd., Mazda House, Newman St., Oxford St., W.1.
M.C.L. & REPETITION Motor-car electrical equipment and automatic screw machine products	M.C.L. & Repetition, Ltd., Pool Lane, Langley, Birmingham.
M.E. Battery-charging switchboards ...	Mann, Egerton & Co., Ltd., Major's Corner, Ipswich.
M.E.C. Small electric motors, a.c. and d.c.	The Medical Engineering Co., Ltd., Englefield Rd., N.1.
MECVENT Organ-blowing equipments, forge blower, industrial fans, &c.	Millns Electrical Co., 17, Whitefriars St., E.C.4.
MEDIUM RESISTANCE Special high-quality dynamo sheets and stampings	Joseph Sankey & Sons, Ltd., Bilston, Staffs.
MEGGER Electrical instruments	Evershed & Vignoles, Ltd., Acton Lane Wks., London, W.4.
MEGGERLAC Grey enamel for insulating all classes of electrical windings where heat dissination is desired	Pinchin, Johnson & Co., Ltd., General Bldgs., Aldwych, W.C.2.
MEGOHMOID Cable materials	Lindsay & Williams, Ltd., Bennett St. Works, Ardwick, Manchester.
MEMETTE Ironclad switches	Midland Electric Mfg. Co., Ltd., M.E.M. Works, Barford St., Birmingham.
MEM8 Insulated switches	Midland Electric Mfg. Co., Ltd., M.E.M. Works, Barford St., Birmingham.
MEMREX Ironclad switches	Midland Electric Mfg. Co., Ltd., M.E.M. Works, Barford St., Birmingham.
MEMSET Splitters (D.P. switch with 4 S.P. fuses)	Midland Elec. Mfg. Co., Ltd., Barford St., Birmingham.
MERSEY Dynamos and motors	McClure & Whitfield, Stockport.
MERSEY Motors	City Electrical Co., 1, Emerald St., W.C.1.
MERSEY CABLES Rubber-insulated wires and cables...	Mersey Cable Works, Ltd., Linacre Lane, Bootle, Liverpool.
MET-VICK Electric appliances, wiring accessories and supplies of all kinds	Metro-Vick Supplies, Ltd., 155, Charing Cross Rd., W.C.2.
MET-VICK-RAY All metal shop window reflectors ...	Metro-Vick Supplies, Ltd., 155, Charing Cross Rd., W.C.2.
METROHM Insulation tester	Everett, Edgcumbe & Co., Ltd., Colindale Works, Hendon, N.W.9.
MICANITE Insulating material	Mica & Micanite Supplies, Ltd., Offord St., N.1.
MICANITE Insulating sheet, tubes, washers, &c.	The Micanite & Insulators Co., Ltd., Empire Works, Blackhorse Lane, E.17.
MIDGET MASTA Fuse switch	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
MILL Circuit breakers	Geo. Ellison, Perry Barr, Birmingham.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
MINIMAX Bakelite side-entry cord-grip plugs ...	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, 477-489, Liverpool Rd., Holloway, N.7.
MONEL Nickel alloy, anti-corrosive metal ...	G. & J. Weir, Ltd., Cathcart, Glasgow.
MOONSTONE Glassware	Underwood (Manchester), Ltd., 1, Dickinson St., Manchester.
MORCO Illuminating glassware, electrical accessories, heating apparatus	T. B. Morley & Co., Ltd., Jameson St., Hull, and Leeds.
MORGANITE Brushes	The Morgan Crucible Co., Ltd., Battersea Works, Church Rd., S.W.11.
MORGANITE Electric heaters	The Morgan Crucible Co., Ltd., Battersea Works, Church Rd., S.W.11.
MORTISE Single-way small narrow-panel tumbler switches	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
MOSAIC Fires and paint removers	Girlings, Ltd., Electricity Works, Maldon, Essex.
MOULDENSITE Moulding powders and impregnating varnishes	Mouldensite, Ltd., Darley Dale, Derbyshire.
MOULDENSITE Moulding materials	Bakelite, Ltd., 68, Victoria St., S.W.1.
MUELLER Universal test clips	L.P.S. Electrical Co., Ltd., Avenue Rd., Acton, W.3.
MULPARVO A utility heater	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
M.V. Wiring materials, accessories and electric apparatus of every description	Metro-Vick Supplies, Ltd., 155, Charing Cross Rd., W.C.2.
N Insulating tape	St. Helens Cable & Rubber Co., Ltd., Slough.
NALDERS Electrical measuring instruments and relays of all types	Nalder Bros. & Thompson, Ltd., 97a, Dalston Lane, E.8.
NARROW OBLONG Two-pin panel plug connectors ...	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
N.B.D. Electrical plant	Newton Bros. (Derby), Ltd., Alfreton Rd., Derby.
N.C.S. Electrical measuring instruments and relays of all types	Nalder Bros. & Thompson, Ltd., 97a, Dalston Lane, E.8.
NECO Electric motors ⅛ to 1 h.p., a.c. and d.c.	Normand Electrical Co., Ltd., 3, North Side, Clapham Common, S.W.4.
NEPTUNE Bare wires of all descriptions, insulated wires, telegraph, telephone and submarine cables	W. F. Dennis & Co., 70, Queen Victoria St., E.C.4.
NESDRUM W.T. boilers	Richardsons, Westgarth & Co., Ltd., Hartlepool.
NEWBERRY Magi-oal fires	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
NEWBRIDGE Time switches	Horstmann Gear Co., Ltd., Newbridge Works, Bath.
NEWTONS OF TAUNTON A.c. and d.c. dynamos and motors, l.t. switchgear, &c.	Newtons of Taunton, 6, Grape St., W.C.2.
NICHRO Electric domestic irons	Cranmer & Cheshire, 9, Steward St., Spring Hill, Birmingham.
NICO Fittings, glassware and accessories ...	Nico Light Co., Ltd., 19, Farringdon Avenue, E.C.
NIPHAN Couplings and plugs for cables ...	Simmonds & Stokes, Ltd., 4, Vernon Place, Southampton Row, W.C.1.
NO-LAG Induction motors	British Thomson-Houston Co., Ltd., Rugby.
NOMET Special wiring system and fittings ...	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
NOVEL Switch, 5-amp. tumbler type, fitted with extra terminal for looping	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
OASIS Accumulator acid, acid-resisting paint	General Chemical & Pharmaceutical Co., Ltd., Willesden, N.W.10.
OHMALINE Insulating varnish	Griffiths Bros. & Co., London, Ltd., Macks Rd., S.E.16.
OHMER Insulating testing sets	Nalder Bros. & Thompson, Ltd., 97a, Dalston Lane, E.8.
OKONITE Insulating tape	William Geipel, Ltd., Vulcan Works, 156-170, Bermondsey St., S.E.1.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
OLONITE Electric cables	The Greenwich Cable Works, Ltd., Crooms Hill, Greenwich, S.E.10.
OMEGA Vacuum electric lamps of all kinds	Omega Lampworks, Ltd., Rodney Place, Merton Abbey, S.W.19.
ONE-DER Loudspeaker	Edison Swan Electric Co., Ltd., 123-5, Queen Victoria St., E.C.4.
ORB Switchgear, ironclad	Geo. M'Cartney & Co., Burnside Works, Cumnock, N.B.
ORBIT Traversing desk bracket or cabin fan, for commercial or marine use	Veritys, Ltd., Plume Works, Aston, Birmingham.
OSRAM Various types of valves for reception and transmission, bright and dull emitter for both general and special purposes	M.O. Valve Co., Ltd., Osram Works, Brook Green, Hammersmith.
OSRAM Electric lamps for all conditions of lighting	General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.
OSRAM Wireless valves of all types for general and special requirements	General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2
OWL Porcelain	Geo. Wade & Son, Ltd., Manchester Pottery, High St., Burslem, Staffs.
OZONAIR Ozone apparatus, pure air ventilation	Ozonair, Ltd., 96, Victoria St., S.W.1.
P. & G. Accumulators	Pritchett & Gold & E.P.S. Co., Ltd., 50, Grosvenor Gardens, S.W.1.
P. & R. Accumulators for cars and wireless	Peto & Radford, Props.: Pritchett & Gold & E.P.S. Co., Ltd., 50, Grosvenor Gardens, S.W.1.
PAKYDERM Finishing varnish	Griffiths Bros. & Co., London, Ltd., Macks Rd., S.E.16.
PARAGON Air pump	G. & J. Weir, Ltd., Cathcart, Glasgow.
PAXOLIN Varnished paper boards, insulators, tubes, &c.	The Micanite & Insulators Co., Ltd., Empire Works, Blackhorse Lane, Walthamstow, E.17.
PEERLESS Insulator and fibre	Attwater & Sons, Hopwood Street Mills, Preston.
PEERLESS Single-phase repulsion induction motors, generators and fans	S. G. Leach & Co., Ltd., 26-30, Artillery Lane, E.1.
PEERLESS Insulation paper	J. Burns, Ltd., Wangye Works, Chadwell Heath, Essex.
PEERLESS Insulation	The Micanite & Insulators Co., Ltd., Empire Works, Blackhorse Lane, Walthamstow, E.17.
P.E.H. Heating apparatus	Premier Electric Heaters, Ltd., Keeley St., Watery Lane, Birmingham.
PELAPONE Country-house electric lighting plants	New Pelapone Engine Co., Ltd., 41, Baker St., W.
PERCO-WASH Electric clothes-washing device and washboiler	The Jackson Electric Stove Co., Ltd., 143, Sloane St., S.W.1.
PERNAX Electric cables	The Greenwich Cable Works, Ltd., Crooms Hill, Greenwich, S.E.10.
PERTINAX Impregnated paper (bakelite base) tubes and boards	Geo. L. Scott & Co., Ltd., 69, Fleet St., E.C.4.
PETROLEX Fire extinguishers for electrical equipment	Read & Campbell, Ltd., 75, Victoria St., Westminster, S.W.1.
PHENOLITE Laminated bakelite	J. Burns, Ltd., Wangye Works, Chadwell Heath, Essex.
PHLATTA Switches	The Edison Swan Electric Co., Ltd., 123-5, Queen Victoria St., E.C.4.
PHONOPORE Telephones for superimposing on telegraph lines	Sterling Telephone & Elec. Co., Ltd., Dagenham, Essex.
PINNACLE Switch fuses, enclosed fuses, &c.	Pinnacle Switchgear & Fuse Co., Weybridge, Surrey.
PIONEER Turn-type switches and switch plugs	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
PIRELLI-GENERAL Wires, cables and flexibles	The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.
PIVOT Single and two-way tumbler switches	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
PIVOT COMBINATION Tumbler switch and two-pin connector	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
PIVOT INTERMEDIATE Tumbler switches for control of lamps from more than two positions	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
PIXY Bell pushes with straight-line movement	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
PLANIA Arc lamp carbons, carbon brushes, carbon battery plates, &c.	William Geipel, Ltd., Vulcan Works, 156-170, Bermondsey St., S.E.1.
P.M. VALVES Dull filament receiving valves ...	Mullard Wireless Service Co., Ltd., Mullard House, Denmark St., W.C.2 (Distributors). Mullard Radio Valve Co., Ltd., Nightingale Works, Nightingale Lane, S.W.12 (Manufacturers).
POINTOLITE Lamps	Edison Swan Electric Co., Ltd., 123-5, Queen Victoria St., E.C.4.
PRACHE Foundations for preventing vibrations	Fred. J. Down, 90-98, Fenchurch St., E.C.3.
PREMIER Fires	Premier Electric Heaters, Ltd., Keeley St., Watery Lane, Birmingham.
PREMIER Accumulators	Premier Accumulator Co. (1921), Ltd., Cattle Market Rd., Northampton.
PREMIER Electric vacuum cleaner	Hotpoint Electric Appliance Co., Ltd., 24, Newman St., Oxford St., W.1.
PREMIER DUPLEX Electric vacuum cleaner	Hotpoint Electric Appliance Co., Ltd., 24, Newman St., Oxford St., W.1.
PREMIER JUNIOR Electric vacuum cleaner	Hotpoint Electrical Appliance Co., Ltd., 24, Newman St., W.1.
PRESCOT Box compounds	British Insulated Cables, Ltd., Prescot, Lancs.
PRESCOT Feeder pillars	British Insulated Cables, Ltd., Prescot, Lancs.
PRESCOT Joint boxes	British Insulated Cables, Ltd., Prescot, Lancs.
PRESCOT Overhead equipment for electric railways and tramways	British Insulated Cables, Ltd., Prescot, Lancs.
PRESCOT Paper insulated cables	British Insulated Cables, Ltd., Prescot, Lancs.
PRESCOT Cotton-covered wires	British Insulated Cables, Ltd., Prescot, Lancs.
PRESTO Single and two-way pendant switches	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, 477-489 Liverpool Rd., Holloway, N.7.
PRISMATIC Bulkhead fitting	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
PROMETHEUS Electric irons, radiators, water heaters, &c.	Dowsing Radiant Heat Co., Ltd., Bollo Lane, Acton, W.3, and 91-3, Baker St., W.1.
PUL-SYN-ETIC Electric impulse clocks and time discipline apparatus	Gent & Co., Ltd., Faraday Works, Leicester.
QUASI-ARC Electric welding plants and electrodes	Quasi-Arc Co., Ltd., 15, Grosvenor Gardens, S.W.1.
QUEAD Electric fires and cookers	William Geipel, Ltd., Vulcan Works, 156-170, Bermondsey St., S.E.1.
QUICKWAY Coil-winding and forming machinery	Midland Dynamo Co., Ltd., 64, Belgrave Gate, Leicester.
RADIODESCENT Appliances for radiant heat treatment	Dowsing Radiant Heat Co., Ltd., Bollo Lane, Acton, W.3, and 91-3, Baker St., W.1.
RADIOMATIC Broadcast receivers	Gent & Co., Ltd., Faraday Works, Leicester.
RADION Insulating material	American Hard Rubber Co. (Britain), Ltd., 13a, Fore St., E.C.2.
RAPPER Percussive hand-drill for wall plugs	Wm. Geipel, Ltd., Vulcan Works, 156-170, Bermondsey St., S.E.1.
RECORD Insulation testers, battery cut-outs, circuit breakers	Record Electrical Co., Ltd., Broadheath, Altrincham, Cheshire.
REDMANOL Moulding materials	Bakelite, Ltd., 68, Victoria St., S.W.1.
REESILEO Oils, insulating and lubricating ...	Reesoils, Ltd., 1, Eldon Sq., Newcastle-on-Tyne.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
REFLEX Control of pendulums of existing workmen's recorders and other pendulums	Gent & Co., Ltd., Faraday Works, Leicester.
REGAL Ebonite	Spicers, Ltd., 19, New Bridge St., E.C.4.
RELAY Automatic telephone and calling installations	Relay Automatic Telephone Co., Ltd., Marconi House, Strand, W.C.2.
RELIANCE Circuit breakers	Whipp & Bourne, Castleton, Manchester.
REMY Permanent tungsten steel magnets and magnet steel	W. F. Dennis & Co., 70, Queen Victoria St., E.C.4.
REPELLITE Insulating sheets	Spicers, Ltd., 19, New Bridge St., E.C.4.
RESILIA Pyrometers, electrical high precision instruments, miniature electrical instruments	Foster Instrument Co., Letchworth, Herts.
RESISTON Insulating material	American Hard Rubber Co. (Britain), Ltd., 13a, Fore St., E.C.2.
RESTFULITE Electric standards	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
REVELATION Guaranteed lamps, flashing adaptors, heaters, &c.	Electroservice, Ltd., 3, Waterloo Rd., S.E.1.
REVERSING Tumbler switch, with or without "off" position	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
REX A.c. meters	Thompson & Co., 1 & 3, Old Swan Lane, E.C.4.
RHECO Switchboards and switchgear fittings, ceiling dustproof fittings, cast iron, weatherproof	Robinson & Hands Elecl. Co., Ltd., Barwick St., Birmingham.
R.L.M. One-piece reflector fitting	Benjamin Electric, Ltd., Brantwood Works, Tariff Rd., N.17.
RODALUX Street lighting reflector fitting ...	Benjamin Electric, Ltd., Brantwood Works, Tariff Rd., N.17.
ROYAL EDISWAN Lamps	Edison Swan Electric Co., Ltd., 123-5, Queen Victoria St., E.C.4.
RUPTOR Ironclad switch	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
SADIA Automatic water heater	Sadia, Ltd., 22, Newman St., W.1.
SAFETEE Switches	L. Weekes (Luton), Ltd., Langley St., Luton, Beds.
SAFUSE Fuses and combined switch fuse and interlocked switch plugs	Donovan & Co., 47, Cornwall St., Birmingham.
ST. HELENS Cab tire sheathed (C.T.S.) cables, dialite cables	St. Helens Cable & Rubber Co., Ltd., Slough.
ST. HELENS Ebonite, corrosion-proof fittings ...	St. Helens Cable & Rubber Co., Ltd., Slough.
ST. HELENS Insulating matting, insulating gloves, insulating shoes	St. Helens Cable & Rubber Co., Ltd., Slough.
SALFORD Circuit breakers	General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.
SANGAMO-EDISWAN Meters	Edison Swan Electric Co., Ltd., 123-5, Queen Victoria St., E.C.4.
SANTON Switching plugs, geysers, wash boilers, &c.	Santon, Ltd., Dock St., Newport, Mon.
SATCHWELL Thermostat for electrically heated rooms, water heaters, ovens, &c.	The Rheostatic Co., Ltd., Mackenzie St., Slough, Bucks.
SATCHWELL Thermostats	The Rheostatic Co., Ltd., Mackenzie Street, Slough, Bucks.
SAUTER Time switches and thermostats	Nathan & Allen, Ltd., 25, Victoria St., London, S.W.1.
SAVELITE Oval a.c. incandescent lamp	Philips Lamps, Ltd., 145, Charing Cross Rd., W.C.2.
S & C Turned and screwed repetition parts from bar in brass and steel, capstan and auto productions and pressings from sheet	Spears & Company, Capstan Repetition Works, 68, Park Rd., Hockley, Birmingham.
SCHERBIUS Phase advancers and a.c. motor speed regulators	British Brown Boveri, Ltd., Trafalgar House, Waterloo Place, S.W.1.
SCRULIX Guy anchors for staying poles, &c.	F. J. Down, 90-3, Fenchurch St., E.C.3.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
SECTOR Electric irons, fires, accessories ...	Electrical Components, Ltd., 88-90, Gt. Charles St., Birmingham.
SEELCO Wiring system comprising lead-alloy sheathed wires and simple accessories	Siemens Elec. Lamps & Supplies, Ltd., 38 & 39, Upper Thames St., E.C.4.
SELCO Syrens, motors, fans	S G. Leach & Co., Ltd., 26-30, Artillery Lane, E.1.
SELZ Lamp shades	Charles Selz, 47, New Cavendish St., W.1.
SEMAPHITE Cables	Johnson & Phillips, Ltd., Charlton, S.E.
SERIES-PARALLEL Tumbler switch with or without "off" position	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
SERVICE Grid resistances and accessories ...	The Rheostatic Co., Ltd., Mackenzie St., Slough.
SHAYDOLITE Lamp lacquer	Griffiths Bros. & Co., London, Ltd., Macks Rd., S.E.16.
SHIPTON Automatic telephone systems	Shipton Automatic Telephone System, Ltd., Caxton House, Tothill St., S.W.1.
SIEMENS Electric lamps	Siemens Elec. Lamps & Supplies, Ltd., 38 & 39, Upper Thames St., E.C.4.
SIEMENS Electric pyrometers and distance thermometers	Siemens Bros. & Co., Ltd., Woolwich, S.E.18.
SIEMENS Batteries—fluid and dry	Siemens Bros. & Co., Ltd., Woolwich, S.E.18.
SIEMENS Ebonite	Siemens Bros. & Co., Ltd., Woolwich, S.E.18.
SIEMENS Joint boxes, feeder pillars, house service fuse boxes	Siemens Bros. & Co., Ltd., Woolwich, S.E.18.
SIEMENS Electric cables and wires of all types	Siemens Bros. & Co., Ltd., Woolwich, S.E.18.
SIFAM Electrical and radio measuring instruments and instrument transformers	Sifam Electric Instrument Co., Ltd., Bush House, Aldwych, W.C.2.
SILUMINITE Switchboards, mouldings, &c. ...	Siluminite Insulator Co., Ltd., Erith, Kent.
SILVALUX Electric lamps (opal)	Siemens Elec. Lamps & Supplies, Ltd., 38 & 39, Upper Thames St., E.C.4.
SILVARAY One-piece glassware fittings	Siemens Elec. Lamps & Supplies, Ltd., 38 & 39, Upper Thames St., E.C.4.
SILVERSTONE Decorative glassware, shades, bowls and enclosed lighting units	Metro-Vick Supplies, Ltd., 155, Charing Cross Rd., W.C.2.
SILVERTOWN Cables, instruments, &c.	India Rubber, Gutta Percha & Telegraph Works Co., Ltd., 106, Cannon St., E.C.4.
SIMBAKE Switches, holders and accesscries ...	Simpson, Baker & Co., 2-5, Nelson St., Bristol.
SIMPLEX Jacks	Equipment & Engineering Co., 2 & 3, Norfolk St., W.C.2.
SIMPLEX Conduits and all electric installation equipment	Simplex Conduits, Ltd., Garrison Lane, Birmingham.
SIMPLEX "Ordinary" and "Reverse" door contacts	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
SINDANYO Insulating and arc-resisting boards	Turner Bros. Asbestos Co., Ltd., Rochdale.
SINEW Wireless terminals	Clarkes, Sinew Works, Redditch.
SIROCCO Fans	Davidson & Co., Ltd., Sirocco Eng. Works, Belfast, Ireland.
SISSON Enclosed self-lubricating steam engines	W. Sisson & Co., Ltd., Elmbridge Rd., Gloucester.
SISTOFLEX Insulating sleeving, fibre and leatheroid	Spicers, Ltd., 19, New Bridge St., E.C.4.
SISTOFLEX Varnished cloth, paper, tapes, &c. ...	Spicers, Ltd., 19, New Bridge St., E.C.4.
SLOTTED STEEL Pierced steel angles, channels, flats, &c.	Constructors, Ltd., Imperial House, Charlotte St., Birmingham.
SMOOTHWELL Irons	Premier Electric Heaters, Ltd., Keeley St., Watery Lane, Birmingham.
SOLARIUM Electric sun baths	Dowsing Radiant Heat Co., Ltd., Bollo Lane, Acton, W.3, and 91-3, Baker St., W.1.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
SOLBIT Solid bitumen mining cables	W. T. Glover & Co., Ltd., Trafford Park, Manchester.
SOTONITE Insulated cables	Pirelli-General Cable Works, Ltd., Southampton and Eastleigh.
SOVEREIGN Dry cells	Atlas Carbon & Battery Co., Ltd., 56, Southwark Bridge Rd., S.E.1.
S.P. Shortpath wireless valves, blue spot, green spot and red spot	Metro-Vick Supplies, Ltd., 155, Charing Cross Rd., W.C.2.
SPECIAL LOHYS Electrical sheets and stampings ...	Joseph Sankey & Sons, Ltd., Bilston, Staffs.
SPENCER-BONECOURT Waste heat boilers, economisers, Kirke patent boilers, &c.	Spencer-Bonecourt, Ltd., Broadway Buildings, 50-64, Broadway, S.W.1.
SPIROGLIDE Turbine pump	Harland Engineering Co., Ltd., B.E.P. Works, Alloa, Scotland.
SPLENDOR Electric lamp manufacturers	M.S.L., Ltd., Splendor House, 67, Hammersmith Rd., W.14.
SPRAYIT ELECTRICALLY Portable electric spraying apparatus, total weight 5½ lb.	L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, Kingsway, W.C.2.
SPRING HAMMER For drilling stone, brickwork, &c. ...	Fred. J. Down, 90-93, Fenchurch St., E.C.3.
STALLOY Transformer sheets, stampings of all shapes, telephone and loud-speaker diaphragms	Joseph Sankey & Sons, Ltd., Bilston, Staffs.
STANDARD Vacuum sweepers, washing and ironing machines	Standard Telephones & Cables, Ltd., Connaught House, Aldwych, W.C.2.
STANDARD Cables of all types	Standard Telephones & Cables, Ltd., Connaught House, Aldwych, W.C.2.
STANDARD Public address systems	Standard Telephones & Cables, Ltd., Connaught House, Aldwych, W.C.2.
STANDARD Telephones for all purposes, manual and automatic	Standard Telephones & Cables, Ltd., Connaught House, Aldwych, W.C.2.
STANDARD Traffic control system	Standard Telephones & Cables, Ltd., Connaught House, Aldwych, W.C.2.
STANDARD Wireless transmitting and receiving apparatus	Standard Telephones & Cables, Ltd., Connaught House, Aldwych, W.C.2.
STANNOS WIRING SYSTEM V.I.R. wires protected by a watertight tinned copper sheathing suitable for concentric or two-wire installation	Siemens Bros. & Co., Ltd., Woolwich, S.E.18.
STELLA Conduits and conduit fittings	Stella Conduit Co., Ltd., Highfield Works, Bilston, Staffs.
STELLA Electric lamps	Stella Lamp Co., Ltd., Winchelsea Road, Harlesden, N.W.
STERLING Insulating varnishes, solid impregnating compounds, wire enamels	The Sterling Varnish Co., 196, Deansgate, Manchester.
STERLING Telephone systems and equipment ...	Sterling Telephone & Elec. Co., Ltd., Dagenham, Essex.
STERLING Mine phones and signalling apparatus	The Marconiphone Co., Ltd., 210-212, Tottenham Court Rd., W.1. (Sole Agents for Sterling Telephone & Electric Co., Ltd.)
STERLING Telephones and kindred apparatus ...	The Marconiphone Co., Ltd., 210-212, Tottenham Court Rd., W.1. (Sole Agents for Sterling Telephone & Electric Co., Ltd.)
STROWGER Public automatic telephones and exchange equipment, private automatic exchanges	Automatic Telephone Manufacturing Co., Ltd., Strowger Works, Milton Road, Edge Lane, Liverpool.
SUDDEUTSCHE Cable and flexible	"Z" Electric Lamp & Supplies Co., Ltd., 73, Newman St., W.1.
SUNBEAM Magicoal fire	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
SUNBLAZE Magicoal fire	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
SUNRAY Radiators	British Electric Transformer Co., Ltd., Wellington House, 125-130, Strand, W.C.2.
SUPASTONE Illuminating lighting glassware ...	Wholesale Fittings Co., Ltd., 23-27, Commercial St., E.1.
SUPAUL Electric cables, electrical accessories, electric signs	Superlamp, Ltd., 92-94, Paul Street, E.C.2.
SUPER-BOX House-wiring joint box	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
SUPER DREADNOUGHT Fuse switch	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
SUPERLUX Glassware	The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.
SUPERSCALE Indicating instruments	Everett Edgcumbe & Co., Colindale Works, Hendon, N.W.9.
SUPER SEASONED Vulcanised fibre	J. Burns, Ltd., Wangye Works, Chadwell Heath, Essex.
SUPRONIC Cupro nickel high resistance wire ...	L.P.S. Electrical Co., Ltd., Avenue Rd., Acton, W.3.
SWAN BRAND Electrical cooking utensils with improved safety device	Mayall & Co., Ltd., 61, Moor St., Birmingham.
SWANLITE Unit lighting fittings	The Edison Swan Electric Co., Ltd., 123-5, Queen Victoria St., E.C.4.
SYNCHRONOME Electric clocks	Synchronome Co., Ltd., 32-4, Clerkenwell Rd., E.C.1.
TANGENT Sound signals, ironcased and woodcased, and RADIO apparatus	Gent & Co., Ltd., Faraday Works, Leicester.
TATE Electric stop motion (safety device for engines)	James Tate & Co., Victory Works, Bradford.
TAYLOR-SCOTSON Pressure regulator	Cox-Walker & Partners, Darlington.
T.C.C. Mansbridge condensers, mica condensers, power factor improvement condensers	Telegraph Condenser Co., Ltd., Wales Farm Rd., North Acton, W.3.
TELAC Tumbler switches, accessories, switchgear, ironclad gear	J. H. Tucker & Co., Ltd., King's Rd., Tyseley, Birmingham.
TELENDURON Insulators for telegraph and telephone lines, also insulation mouldings for electrical trade	Thos. De la Rue & Co., Ltd., Shernhall St., Walthamstow, E.17.
TELETYPE Printing telegraph apparatus, &c.	Standard Telephones & Cables, Ltd., Connaught House, Aldwych, W.C.2.
TERRA-GRIP Continuity wiring system	Simplex Conduits, Ltd., Garrison Lane, Birmingham.
TERRAPIN Two-pin and "earth" plug connectors	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
TEST SHEATH Test conductor for underground electric cables	W. T. Glover & Co., Ltd., Trafford Park, Manchester.
THERMOID Flexible cord	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
THISTLE Conduit tubes and fittings	James McDougall, Ltd., Wednesbury, Staffs.
THISTLE Galvanised span and guard wire strand to M.T.A. specification	Frederick Smith & Co. Wire Manufacturers, Ltd., Halifax.
THISTLE Tinned steel armature binding wire	Frederick Smith & Co. Wire Manufacturers, Ltd., Halifax.
THREE STAR Accumulators	Three Star Accumulators, Ltd., Rosebery Avenue, N.17.
TIP-TOP Push-button switch for motor horns	Benjamin Electric, Ltd., Brantwood Works, Tariff Rd., N.17.
TIRRILL Automatic voltage regulators	British Thomson-Houston Co., Ltd., Rugby.
TREVA Electrical accessories	Trevelyans (B'ham), Ltd., 155, Bracebridge St., Birmingham.
TRICITY Cookers	British Electric Transformer Co., Ltd., Hayes, Middlesex.
TRICITY Cookers and tableware	British Electric Transformer Co., Ltd., Wellington House, 125-130, Strand, W.C.2.
TRIPIN Three-pin plug connector (all current-carrying pins)	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
TRIUMPH Fuses, ironclad fuse gear, "Castle" plugs and sockets	Castle Fuse & Engineering Co., Ltd., 33, Chester St., Liverpool.
TROJAN Electric irons, electric lamps and electric kettles	John Shaw & Sons (Wolverhampton), Ltd., Wolverhampton.
TUCKER Tumbler switches, accessories, switchgear, ironclad gear	J. H. Tucker & Co., Ltd., King's Rd., Tyseley, Birmingham.
TUDOR Batteries	Tudor Accumulator Co., Ltd., Norfolk Street, W.C.2.
TUFNOL Synthetic resin paper insulation ...	George Ellison, Perry Barr, Birmingham.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
TUNGAR Battery chargers	The British Thomson-Houston Co., Ltd., Mazda House, Newman Street, Oxford Street, W.1.
TUNGSRAM Lamps, wireless valves and batteries	Tungsram Electric Lamp Works (Great Britain), Ltd., Commerce House, 72, Oxford St., W.1.
TUNGSTALITE Electric lamps, accumulators and batteries, crystals (wireless)	Tungstalite, Ltd., 47, Farringdon Rd., E.C.1.
TURRET Multiple-way two-pin plug connector (3 to 6 ways)	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
TWINOB Tumbler switch (either, both or "off"), also a.c. motor control and switch plug	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
TYPERLITE Lighting standard for typewriters and office machines	Electricity Services, Ltd., 86, Cannon St., E.C.4.
ULTRADESCENT Appliances for ultra-violet ray (artificial sunlight) treatment combined with radiant heat	Dowsing Radiant Heat Co., Ltd., Bollo Lane, Acton, W.3, and 91-93, Baker Street, W.1.
UNITALK Intercommunication telephones ...	W. C. Davey & Co., Mortimer Market, W.C.1.
UNITEM "Two-service" adaptor, B.C., 2-pin (adjustable)	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
UNIVERSAL Two-pin plug connectors and switch plugs	A. P. Lundberg & Sons, Ltd., Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
UNIVERSAL House-wiring joint box	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
UNIVERSAL Electric floor polisher	L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, Kingsway, W.C.2.
U-SEAL Corrosion-proof fittings	St. Helens Cable & Rubber Co., Ltd., Slough.
UVRAL Ultra-violet ray (artificial sunlight) apparatus	Bower Electric (1926), Ltd., 27, Ridinghouse St., Gt. Portland St., W.1.
VAC-TRIC Vacuum cleaners, handle and cylinder models	Vac-Tric, Ltd., Broadway Works, Cricklewood, N.W.2.
VANDUARA Insulating tapes	John MacLennan & Co., 115, Newgate St., E.C.1.
VAN RADEN Accumulators	Van Raden & Co., Ltd., Great Heath, Coventry.
VEETA Flat switches, quick make and break	The General Accessories Co., Ltd., "Genex" House, 18-22, Euston Buildings, N.W.1.
VENAUTO Radio time switch	Venner Time Switches, Ltd., 45, Horseferry Rd., S.W.1.
VENNER Time switch, thermostats, and stop watch	Venner Time Switches, Ltd., 45, Horseferry Rd., S.W.1.
VENOFF Photographic and sunray time switches	Venner Time Switches, Ltd., 45, Horseferry Rd., S.W.1.
VENTEX Air filter	Ozonair, Ltd., 96, Victoria St., S.W.1.
VIDAL Portable electric drills and grinders	Vidal Engineering Co., Ltd., Thornton Rd., Croydon, Surrey.
VIKING Fuse switch	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
VINCENT Switch fuse	Vincent Switchgear Mfg. Co., Ltd., Sampson Rd. North, Birmingham.
VIRCLAD Cables	Electric Cables, Ltd., 88, Golden Lane, E.C.1.
VIRITE Electric cable, compound insulation for particularly severe conditions	Edison Swan Cables, Ltd., Lydbrook, Glos.
VISCO Air filter	Visco Engineering Co., Ltd., 162, Grosvenor Rd., S.W.1.
VOLTA Vacuum cleaners — domestic and industrial	Volta, Ltd., Kern House, 36-38, Kingsway, W.C.2.
VULMOS Vulcanised fibre and leatheroid ...	Mosses & Mitchell, Ltd., 122-124, Golden Lane, E.C.1.
WALSALL Steel conduits and fittings	Walsall Hardware Mfg. Co., Ltd., Ablewell St., Walsall.
WARD LEONARD Resistances, dimmers and rheostats	William Geipel, Ltd., Vulcan Works, 156-170, Bermondsey St., S.E.1.
WARWICK Lampholders and fittings, switch and fuse gear	William McGeoch & Co., Ltd., Warwick Works, 46, Coventry Rd., Birmingham.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
"W.E." All classes of conduit fittings ...	Bernard & Co., 9, Horseferry Rd., S.W.1.
WEEKES Fuses	L. Weekes (Luton), Ltd., Langley St., Luton, Beds.
WELDRICS GRADE A Electrodes for welding	Weldrics (1922), Ltd., Station Road, Beeston, Notts.
WELLS Waste oil filters	A. C. Wells & Co., Ltd., 75, Victoria St., S.W.1.
WEMBLEY Street-lighting lanterns	The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.
WESTMINSTER Carbon brush holders, arc lamps (photo and medical), electric welders (Thomson process)	Westminster Engineering Co., Victoria Rd., N.W.10.
WESTON Electrical measuring instruments, instruments for radio service, high frequency thermo instruments	Weston Elecl. Instrument Co., Ltd., 15, Gt. Saffron Hill, E.C.1.
WESTOOL Electric drills and grinders	Westminster Tool & Electric Co., Ltd., Westool Works, 116, Putney Bridge Rd., S.W.15.
WILD BARFIELD Furnaces and muffles	Automatic & Electric Furnaces, Ltd., Elecfurn Works, North Rd., Holloway, N.7.
WILMIL Aluminium castings	Wm. Mills, Ltd., Grove St., Birmingham.
WITTON Electric motors for domestic and industrial uses	The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.
WITTONITE Insulating mouldings	The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.
WOLF Electric tools	S. Wolf & Co., Ltd., 115, Southwark St., S.E.1.
WORK METER Recording instrument for output and idle time of machinery	Lewenz & Wilkinson, Ltd., 25, Victoria St., S.W.1.
WYLEX Switch plugs	Geo. H. Scholes & Co., Ltd., Blantyre St., Hulme, Manchester.
XCEL Electric domestic appliances	Automatic Telephone Mfg. Co., Ltd., Strowger Works, Milton Rd., Edge Lane, Liverpool.
XCEL Electric domestic appliances	Siemens Elec. Lamps & Supplies, Ltd., 38 & 39, Upper Thames St., E.C.4.
XCEL Heating and cooking appliances ...	Downes & Davies, 1 & 3, Stanley St., Liverpool.
X-RAY Shop window lighting reflectors ...	The British Thomson-Houston Co., Ltd., Mazda House, Newman Street, Oxford Street, W.1.
Z Wiring supplies	"Z" Electric Lamp & Supplies Co., Ltd., 73, Newman St., W.1.
ZED Fuses	Siemens Elec. Lamps & Supplies, Ltd., 38 & 39, Upper Thames St., E.C.4.
ZENAL Non-heating fuse element	Parmiter, Hope & Sugden, Ltd., Fluvent Electrical Works, Vernon St., Longsight, Manchester.
ZENITE Resistance units	Zenith Electric Co., Ltd., Zenith Works, Villiers Rd., N.W.2.
ZENITH Transformers, resistances, meter-testing equipment, &c.	Zenith Electric Co., Ltd., Zenith Works, Villiers Rd., N.W.2.
Z.I.R. Rust-proof conduit and fittings ...	Simplex Conduits, Ltd., Garrison Lane, Birmingham.

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the smaller of the earth capacities to the same value as that of the larger.

Inasmuch as fig. 1 shows that in a phantom circuit there are serially connected capacities $x_1 + w_3$, or $x_2 + w_4$, for example, located in parallel with the earth capacity w_1, it does not suffice to balance the partial earth capacities w_1 to w_4 of the individual conductors, but it is also necessary to balance the total capacity complex which these have to earth. This balancing-out of the earth capacity, however, affects the previously mentioned balancing-out of the cross-talk. Hence it is impossible to effect the two kinds of balancing independently of each other; if the cross-talk be balanced out first, it has to be done again after the subsequent earth balancing has been effected and *vice versa*. Therefore, in many cases it is preferable to effect both kinds of balancing before the cable is taken into service, even though initially no high-voltage lines run parallel to it, or at first no stringent conditions have to be fulfilled with regard to freedom from cross-talk. It is necessary to keep within narrow limits any difference in the outgoing and return conductors of a side circuit, or phantom circuit, as regards the resistance of the cable conductors and of the loading coils and the self-induction, in order to reduce the noise induced by the power circuits just as this has to be done to eliminate cross-talk between side and phantom circuits.

The effect produced by any remaining inequality can be removed to a great extent by using the right size of auxiliary condensers.

Apprenticeship in the Electrical Industry.

A Reply by the Apprenticeship Committee of the Association of Supervising Electrical Engineers.

THE carefully considered article in the ELECTRICAL REVIEW of November 30th, 1928, showed that the author had given very close study to the tentative scheme of apprenticeship put forward by the Association of Supervising Electrical Engineers for consideration by the electrical industry.

It is interesting to note his appreciation of the importance, under modern industrial conditions, of making proper apprenticeship training a responsibility of the electrical industry as a whole, and thus lifting apprenticeship from being a question between individual employers and individual apprentices to a higher plane.

While, however, the author appreciates the importance of this "startling development," he has doubts whether the important bodies controlling the electrical industry will realise the desirability of supporting such a policy. We hope and believe that his doubts are not justified, and that the organisations concerned are sufficiently broad-minded to consider the question of apprenticeship on its broadest basis; also that whether the policy underlying the suggested scheme is unorthodox or not, the organisations will not allow that to interfere with their judgment, provided they can see that the industry and those employed therein will benefit.

The author emphasises the fact that the originators of this scheme are not themselves in a position to ensure its operation by the industry. It was for this reason that the general principles of the scheme were put forward as a basis for discussion by the interests concerned.

Among the criticisms of the author are the following:—

He doubts the wisdom of a body representing the whole electrical industry taking over the responsibility of accepting and training apprentices. This is surely the only way to obviate the difficulty of getting the industry as a whole to accept a share of the burden of training apprentices, a difficulty fundamental both in this country and in America. In the General Report No. 7 on "Apprenticeship and Training" (page 164) issued by the Ministry of Labour, there is a clear statement that many firms fail in their duty in this respect, and while no actual figures are given, it is probably correct to say that something like one-half of the electrical firms in the country are not training apprentices.

Further, if it is agreed that a wider education of an apprentice than that available at present is desirable: this can only be ensured by the co-operation of all sections of the industry, and will not be possible so long as the individual firm has the sole responsibility for training its own apprentices. The experiment in this direction tried out in America has already indicated that there is a *prima facie* case made out for collective responsibility.

Criticism is made on another point in which this scheme differs fundamentally from any previous scheme; that is, on the subjects in which the apprentice will receive training. This, undoubtedly, is a matter of opinion, but the suggested training schedule was compiled having in mind the necessity for broadening the early training of every electrical worker in view of the increasing difficulty of obtaining wider experience afterwards, which would enable the ready transference of considerable numbers of workers from one branch of the industry to another, in the event of further fundamental changes, such as those necessitated by the working of the Electricity (Supply) Act, 1926.

Another advantage of the control of apprentices by a Central Apprenticeship Board will be readily appreciated: it would be possible to transfer individual apprentices from one employer to another, or even from one district to another, where this becomes desirable owing to fluctuations of work.

The author's point on the limitation of the number of apprentices employed in proportion to the male employés is well taken, but this clause was inserted to draw attention to the fact that it would be necessary to regulate the supply of apprentices in accordance with the necessity of the industry.

In conclusion, we are grateful for such criticism, inasmuch as it is of the utmost value in bringing into the open the real necessities of our industry, and helps to formulate effective measures for dealing with this very important problem of apprenticeship.

Plant Life.

Sir Jagadis C. Bose, lecturing recently in Calcutta, India, at the Bose Institute, regarding plant life, claimed that experiments which he made proved that a plant was not a mere mass of vegetable growth, but that every fibre was instinct with life. He showed a plant which rang an electric bell as it fed, but ceased to feed when an electric shock was administered, says *The Times*, and on a screen he exhibited the death of a plant attended by "shuddering convulsions" of the vegetable fibre, through which a strong current was being passed.

Compensation Claims.

An examination of the position of employés who suffer loss of status or employment in consequence of the operation of the Electricity (Supply) Acts, 1919-1926.

By J. W. THOMAS, LL.B., B.Sc., A.M.I.E.E.

MANY interesting points are likely to arise in connection with compensation claims under the Electricity Supply Acts, and already numerous queries are being raised both by electricity authorities and by engineers who are likely to be affected. So far only a comparatively small number of cases have been dealt with, and there are thus not many precedents to serve as guides, but sufficient have been decided to enable one to form a fair idea as to how the sections are being interpreted and the lines which are being followed in assessing the amount of compensation payable. It is in regard to the latter point that information is mostly sought for. The engineer whose station is to be closed down or whose mains system is to be taken over and who, as a result, will be dispensed with, naturally asks how much he will be entitled to in the way of compensation, and who will be liable to pay it. There are three primary questions which call for an answer:—

(1) Under what circumstances is compensation payable?
(2) To whom must the claim be made?
(3) How is the amount determined?

The circumstances will obviously depend upon whether the compensation is claimed under Section 16 of the Act of 1919, as modified by Section 21 of the Act of 1922, or under Section 15 of the 1926 Act. As most, if not all, the awards have been given under the 1919 Act, and as there are bound to be others, it is proposed in this article to deal first with cases arising under the 1919 Act and then with those under the 1926 Act.

Who is Entitled to Compensation?

Before an officer or servant can establish a claim for compensation, certain facts must be proved to the satisfaction of a referee or board of referees, *viz.*:—

(1) That after May 8th, 1919*—
  (*a*) A transfer of the whole or any part of an undertaking has been effected, or
  (*b*) A scheme for the improvement of the supply of electricity in any district has come into operation, or
  (*c*) An agreement or arrangement between various authorised undertakers for the rendering of mutual assistance to one another has been entered into.

(2) That the above has been done under or in consequence of the Act of 1919.

(3) That within five years of the date of the transfer, scheme or agreement and in consequence thereof he—
  (*a*) has suffered loss of employment or diminution of salary, wages or emoluments, otherwise than on grounds of misconduct, incapacity or superannuation, or
  (*b*) has relinquished his employment in consequence of being required to perform duties such as were not analogous or were an unreasonable addition to those he had been required to perform, or
  (*c*) has been placed in any worse position in respect to the conditions of his service, including tenure of office, remuneration, gratuities, pension, superannuation, sick or other fund &c.

(4) That he has been regularly employed in or about the undertaking or any authorised undertaking before May 8th, 1919.*

Provided the above conditions are fulfilled, he will be entitled to compensation unless the undertaker against whom the claim is made can show that equivalent employment on the like conditions was available when the transfer was effected, or the scheme came into operation, or the agreement or arrangement was entered into.

The first and most important point to be decided is whether the transfer, scheme or agreement has been done under or in consequence of the Act.

Before the passing of the 1926 Act, the question whether a claim was *in consequence* of the 1919 Act had to be determined by the Commissioners, but there was no provision made as to who was to decide whether a claim was under the Act. Possibly this was because it was thought that no doubts could arise under this head, seeing that the transfer or agreement, &c., must have been done, if under the Act at all, under some definite section. In the case of the "King *v.* The Minister of Labour and Another" (*ex parte* Torquay Corporation) it was decided that the question whether a transfer was under the Act was part of the matter to be determined by the referee, and that if the claimant failed in this he could still submit to the Commissioners the question whether the transfer was in consequence of the Act. In the case of the claim which arose in 1924 against the Chelsea Electricity Supply Co., the action of the referee in deciding that a claim was established under the Act was challenged in the King's Bench Division, on the ground that the agreement was entered into under the London Electricity Supply Acts of 1908 and 1910, which contained no provision for compensation. In giving his decision, however, the Judge expressed the opinion that, whilst the agreement had been entered into under the Act of 1908, it could only come into operation with the assent of the Commissioners, and therefore the Act of 1919 was an essential ingredient of the scheme coming into force. He therefore gave judgment upholding the referee's award.

The 1926 Act has cleared up these difficulties by the amendment of Section 21 of the Act of 1922 so as to provide that any question as to whether a transfer, scheme or arrangement was made under or in consequence of the principal Act shall be determined by the Electricity Commissioners. From their decision there would appear to be no appeal.

Generally speaking, engineers will not have much difficulty in ascertaining for themselves whether a transfer or agreement has been effected or entered into under or in consequence of the Act, by an investigation into the circumstances which have led up to it. If the transfer, &c., has been carried out with the express approval of the Commissioners, then obviously it has been done under the Act. Also, if the Commissioners have definitely refused to an undertaker the necessary sanction to install new generating plant and left no option but for it to take a supply from some other source, so that eventually the undertaker is compelled to close down the station, the arrangements will have been done under the Act. It sometimes happens, however, that the agreement for supply is a mutual one between two undertakers, and has not been entered into at the express request of the Commissioners. A question of this kind was decided in the case of the Llandudno Urban District Council, which entered into an agreement with the North Wales Power Co. for a supply of electricity in bulk, the latter being empowered to give

* A Bill which has passed through almost all its stages rescinds all references to May 8th, 1919.—Eds.

such a supply under the North Wales Power Act, 1904. A term of the agreement provided that the Urban District Council should advance the capital for the construction of the necessary transmission lines, and for this purpose it became necessary for the Llandudno Council to apply to the Electricity Commissioners for sanction to a loan under the terms of Section 19 of the 1919 Act. As a result of the agreement the Llandudno Council ceased to generate its own electricity, and in consequence one of its employés was dismissed. The referee decided that the agreement had been done under the 1919 Act. There is no doubt that the Commissioners, to whom such a question would in future be remitted, would have given a similar decision.

It should be noted that the onus of proving that equivalent employment is available at the date of the transfer is upon the undertaker, but the responsibility of proving that there has been loss of employment or diminution of salary, or that he has been placed in a worse position, &c., is upon the employé. When a transfer scheme or arrangement is effected resulting in the closing down of a generating station, the undertaking affected has several courses optn to it, *e.g.*, it may decide to continue the employé in its service in a similar position at the same salary or dispense with him. If it does the former for a period of five years, no claim for compensation can arise. At the end of that period it can dispense with an employé without incurring any obligation to pay compensation. If the employé can show that his new position is not analogous to his previous one, from the point of view of the duties which he is required to perform, he can decline it and claim compensation for loss of office. It would seem, from a strict interpretation of the Act, that he cannot claim compensation because he has relinquished his employment on account of having been placed in a worse position in respect of his conditions of service, but only in consequence of being required to perform duties such as were not analogous to those previously performed. He can, however, claim compensation for having been placed in a worse position in respect of his conditions of service.

The question naturally arises whether the words "been placed in a worse position" cover loss of status, *e.g.*, a charge engineer in a power station may be reduced to the position of switchboard attendant, and it may reasonably be argued that he has not only suffered a diminution of salary and been placed in a worse position on account of the loss of such benefits as holidays, sick pay, &c., but has suffered in status by being relegated to the rank of workman. Is he entitled to compensation on account of his prospects of securing a position on the technical staff of another undertaking having been materially prejudiced? On the face of it there seems to be no reason why this should not be taken into account, and there is nothing under the terms of the sub-section to exclude it. The point has been argued in at least two arbitrations, *viz.*, Morley and Grays Thurrock. In the first case it was contended that the shutting down of the generating station had altered the status of the borough electrical engineer and made his position worse notwithstanding the fact that his salary had not been reduced. Having been deprived of his active connection with the generating station, his chances of obtaining other positions would be considerably diminished; in fact, his opportunities would be more or less limited to undertakings where there was no generating station. The contention, however, was not upheld by the referee who, in his award, decided that the borough electrical engineer had not proved that he had been placed in a worse position in respect of his conditions of service so as to entitle him to claim compensation under this sub-section. In the case of Grays Thurrock, the claim was put forward that an employé had suffered loss by reason of the fact that the generating station had been closed down, but against this it was argued that this was a loss that could not in any way come within the terms of the Act. The point at issue was whether an employé who had been acting as assistant electrical engineer and who, as a result of an arrangement under the Act, was reduced to switchboard attendant, had been placed in a worse position or not. It was forcibly argued on one side that a man's designation mattered a great deal to him particularly in regard to his future. A rose by any other name might smell as sweet, but on applying for a position the actual title which a man possessed had a great deal to do with his success. If a man was designated assistant engineer and then reduced to switchboard attendant, most engineers would agree that, apart from the question of his salary, he had been placed in a worse position. In his award the referee decided that the employé had suffered diminution of salary and had been placed in a worse position in respect of conditions of employment. It is more than probable, therefore, that in arriving at his decision the referee took some account of this loss in status.

An employé who claims compensation must prove that he had been *regularly* employed with an authorised undertaker. A suggestion was made during one arbitration that the terms "regularly" meant continuously in the sense that there must have been no break in the continuity of the employment, but this view does not appear to have been upheld. The more reasonable construction to be placed upon the term is that the service must not have been intermittent. A temporary break, however, during which an employé may have been engaged outside the supply industry would not prevent him from proving that he had been regularly employed whilst in the actual service of the undertaker. Moreover, in calculating years of service for the purpose of assessing the amount of compensation under the Civil Service Regulations the years of service with an authorised undertaker prior to a break would be counted.

(To be concluded.)

Reviews.

Schlomann Illustrated Technical Dictionaries, Vol. II: Electrical Engineering and Electrochemistry. Revised edition. Pp. 1304; figs. 3965. London: Lewenz & Wilkinson, Ltd. Price £4 net.

"Electrical engineering has developed so rapidly in recent years that the original Technical Dictionary in six languages on Electrical Engineering had to be completely re-written. This work has taken nine years." So opens the introduction to this hefty volume. We are prompted to turn back to our issue of January 24th, 1908, when we expressed our admiration of the first edition—a radical departure from previous practice in the attempt to neutralise the evil effects of the Tower of Babel. We then remarked on the difficulty of accurate translation from one language to another, and the excellent solution to the problem which the authors had provided; by presenting a sketch of the unknown with the corresponding word, they enabled the reader to satisfy himself as to the precise identity of the item referred to. The volume received our warm commendation, and during the 20 years that we have used it, we have had no reason to modify our high opinion of its merits.

But now we have a book more than twice as bulky as its predecessor—"a new work from cover to cover," prepared regardless of expense (the cost approximating to half a million gold marks) under the editorship-in-chief of Mr. Alfred Schlomann (one of the editors of the original edition) with the aid of the German engineering societies and a large body of experts in every country concerned—a monument of labour and knowledge, which is destined to prove of immense value to the electrical profession and industry throughout the whole world. Its arrangement generally follows that of the former edition, the definitions of each item in German, English, Russian, French, Italian, and Spanish being grouped together and accompanied where necessary by an illustration. Many new phrases have been introduced—an important matter, as the construction of phrases with equivalent meanings differs greatly in different tongues. The sections on each page are numbered, and the subjects are segregated, so that all references to "Primary Batteries," for instance, are brought together. The definitions occupy about 800 pages, and are followed by an index occupying 500 pages. Doubtless owing to the enormous number of references, the plan followed originally, in which all the languages (except Russian) were arranged alphabetically has been abandoned, and a separate index for each language is provided, with thumb-cuts to facilitate search. As an example we may select "motor con-

vertor"; this appears under "Electric Machines" in two sections—General, and Theory and Calculation—with slight differences, the former reading "Kaskadenumformer (m); motor convertor, cascade convertor; convertisseur (m) en cascade; commutatrice (f) in cascata; convertidor (m) en cascada" (we have omitted the Russian version). We are told that the indexing involved a "tremendous amount of work" in the course of a few months, and we have noticed several flaws in the English index. However, we do not lay stress on minor defects in so notable a volume, which must prove indispensable to any engineer, of whatever nationality, who is called upon to read electrotechnical literature in other languages than his own.

We should add that this is only one of 16 volumes already issued, which contain over 100,000 expressions, and cover various branches of engineering and other industries; a special telegraph coding scheme has been devised for the editors by Mr. E. L. Bentley, for use with the dictionaries and the Bentley Code. Mr. H. I. Lewenz, M.I.Mech.E., M.I.E.E., is the editor of the British section of the series, and is to be congratulated on the work that has been accomplished.

Excavating Machinery. By W. BARNES, M.I.Mech.E. Pp. xvi+247; figs. 160. London: Ernest Benn, Ltd. Price 42s. net.

After a brief explanation of the fundamental principles involved in the design of excavators—which have attained such dimensions nowadays that some machines weigh 1,200 tons—the author gives a historical sketch of their development, in the course of which it is remarked that electrical power has been used in this connection only since 1899 (up to 1914 only 20 electrical machines had been built); the latest advance, as in the case of transport on land and sea, consists in the development of the Diesel-electric type. An interesting innovation is the use of small excavators, with buckets of half a cubic yard capacity, brought about by the high cost of manual labour. The bulk of the work is devoted to descriptions of a great variety of excavating machines, chiefly, of course, from the mechanical point of view, with a wealth of illustrations; but ten pages are allotted to a discussion of the electric drive and the methods of control adopted. Owing to the extreme variations of load, the control is particularly important, and various systems have been tried, including constant voltage with rheostatic control, and variable voltage with constant current; the former is suitable for machines of small and medium size, and the latter for large machines, but the advantages of voltage control have led to its use also on those of medium size. Constant voltage requires the provision of devices to prevent overloading when too heavy a cut is taken, or when rocks are met with; these are not necessary with the variable-voltage system, which is altogether simpler in operation, but somewhat more expensive in first cost. Particulars of working costs of electrically operated machines, recorded in actual practice, are given, from which it appears that the d.c. system is somewhat more economical than a.c. Large installations of electrical excavators in the United States, Chile and Sweden, are illustrated and described.

The book is essentially of a specialist character, and contains a vast amount of information of value both to the constructor of such machinery and to the user, whose needs are specially catered for.

Dielectric Phenomena. II.—Electrical Discharges in Liquids. By S. WHITEHEAD, M.A. Pp. 137; figs. 67. London: Ernest Benn, Ltd. Price 12s. 6d. net.

This book, the second of the series being prepared for the Electrical Research Association, differs in arrangement from its companion volume upon gaseous discharges. The necessity for a change is fairly obvious; a single comprehensive theory, that of ionisation by collision, binds together the whole of the gas phenomena, but there is no theory completely adequate to account for all the still incompletely explored phenomena of breakdown in liquids. The plan adopted has therefore been to describe first the facts that have been established by experiment, in the first seven chapters, and then to consider their significance, in the last one.

After a short introductory note, the subject of impurities is introduced in a chapter devoted to their general action, their characteristic effects under specific conditions being considered later. Solid, liquid and gaseous admixtures are dealt with in turn, and special attention is paid to the important practical question of the influence of moisture upon B.D.V., the subsections in this connection being upon voltage-moisture breakdown curves, the settling out of suspended moisture, the effect of emulsification, the effect of water condensed or absorbed on nuclei and fibres, and the effect of water in solution. New E.R.A. tests upon several of these points are described here, and there is no indication that they are to be published elsewhere: the same statement applies to the majority of the many new E.R.A. results that appear in other parts of the book. The second chapter, which is again very systematic, is upon the influence of the form of the field upon B.D.V. We notice that it is tacitly assumed that the field can be calculated from the geometry of the electrodes; it would be extremely valuable if this could be verified by some direct measurement of the fall of potential through a liquid, since it is known that large concentrations of the field at the electrodes are set up in the cases of gases and solids by polarisation consequent upon the passage of small initial currents. The effects of temperature and pressure are dealt with in Chapter III; from the evidence presented there appears little room for doubt that there is both an intrinsic effect in the pure liquid, leading to a decrease in B.D.V. with increase in temperature, and a diminution in the effects of impurities under the same circumstances which leads to an increase in B.D.V. In Chapter IV, upon lag and allied phenomena, we notice that the E.R.A. tests indicate that there is a real deterioration of a pure liquid when it is subjected to continued high stress, and that both a minimum voltage and a minimum of available energy seem to be required before a discharge can pass. The effect of the material of the electrodes, the comparison of the B.D.V. of different liquids, and the phenomena of preliminary sparking and corona are disposed of very briefly in the next three chapters; little is known of any of these subjects, and indeed the first two are not of great practical importance, since it is usually the impurities present that exercise the main control. Corona, however, is likely to receive more attention in the future, and it is stated that a further report upon it is in preparation for the E.R.A.

After following through Mr. Whitehead's descriptions to this stage, the reader will certainly concur with his statement that there are no generally accepted quantitative laws governing liquid breakdown, and will appreciate that the various theories of the phenomenon that have been put forward are mainly qualitative and not susceptible of exact test. The great difficulty is to decide how far it is the liquid that matters, and how far it is the impurities in the liquid; Mr. Whitehead avoids making this decision by stating both views, with little comment upon their relative merits. Two points mentioned in connection with the hypothesis of ionisation by collision are outstanding—first, that it does not enquire into the mechanism by which new ions are produced, and second, that it could lead to breakdown without the necessity of any decomposition of the liquid other than that required for the formation of new ions. In connection with the vaporisation theory, we notice that one variation of it was supported by the high authority of Steinmetz. Perhaps a careful study of the spectra of under-liquid sparks, upon which there is a considerable physical literature, would throw light on these problems. The discussion of the possible effects of impurities, when present, covers short-circuit by a conducting bridge, narrowing of a gap by formation of a chain upon an electrode, homogeneous deterioration of the liquid, and the effects of isolated nuclei in the gap. There is an appendix on testing apparatus, a bibliography of references not mentioned in the text, and a subject index.

We have come across only one misprint in the book, and that trivial. It is in every respect excellent, and both Mr. Whitehead and the publishers are to be congratulated upon their production, which, we believe, will attain the recognition as a standard work of reference to which it is entitled.

Automobile and Radio Batteries. A Practical Manual by Harold H. U. Cross. Pp. vii+128; figs. 53. London: Crosby Lockwood & Son. Second Edition. Price 3s. 6d. net.

This book forms one of Crosby Lockwood's series of Manuals for Trade, Craft and Industry, and the fact that a second edition has been called for would seem to indicate that it is proving useful to those interested in the use and repair of primary and secondary batteries. The book is divided into seven chapters, three of which deal respectively with the dry, the lead storage and the alkaline storage battery. One is devoted to charging, one to the repair and upkeep of lead cells, one to "how to make an alkaline 'h.t.' battery," and one to service station repairs. The text is written in simple language, and while it may not have such a wide appeal as the author outlines in his preface, it should prove very useful to employés in the rapidly increasing number of battery-charging and repair departments of motor car and wireless service stations who are desirous of obtaining a better understanding of the basic principles of the articles they are called upon to deal with in their daily work.

Despite its useful features, we have a feeling of disappointment with the new edition, in that, while it covers the technical side of the subject fairly completely in the space at disposal, it is not quite up-to-date from the practical aspect, some of the illustrations, for example, depicting plant and apparatus of a somewhat aged design. Probably also as a result of the author's travels in many lands, his text has, in our opinion, rather too wide an appeal for a work published in Great Britain. To give an example of what we mean, we doubt if many British readers will grasp the meaning of the phrase on page 25, "When an 'electric' is 'bucking' a grade." We ourselves, while realising that by "electric," an electric motor vehicle is alluded to, and that grade is American for a gradient or hill, are a little puzzled at the "bucking"! Again, in an English book it is not usually expected to find an instruction as to the periods when distilled water should be added to accumulators "when touring in places like Arizona or the Karoo."

What with their use in wireless installations and on motor vehicles for lighting and engine-starting purposes, there is now not only a big business being done in the manufacture of small size accumulators, but in their charging, repair and general maintenance. In the latter connection in particular there is undoubtedly room for a handbook written in simple language for the benefit of those engaged in this work. If the author desires to be the one to fulfil this requirement, we venture to suggest the time has come when he should re-write the manual completely, basing it on the modern British practice, which has been so greatly developed.

The British Industries Fair.

A List of Electrical Exhibitors at Birmingham.

THERE is every promise that the 1929 British Industries Fair will excel its predecessors, particularly the Birmingham Section with which we are most concerned. Practically all the available space, including that provided by the recent extensions, has been taken, and there are about 700 exhibitors. We have selected from the list received from Mr. C. Stanley, the general manager of the Birmingham Section, about 120 companies and firms who will show electrical apparatus or products of an allied character. We consider that the proportion which these bear to the total number, namely, about 17 per cent., is very satisfactory, having regard to the extremely varied nature of the Fair.

Allen-Liversidge, Ltd., London, S.W.
Ashdown, H. E., Birmingham, Ltd.
Avery, W. & T., Ltd., Birmingham.

Bakelite, Ltd., London, S.W.
Beard & Fitch, Ltd., London, E.C.
Berkeley & Young, Ltd., Birmingham.
Berry's Electric, Ltd., London, W.
Birkbys, Ltd., Liversedge, Yorks.
Birmingham Electric Furnaces, Ltd.
Birmingham Electric Supply Dept.
Blackstone & Co., Ltd., Stamford, Lincs.
Boulton & Paul, Ltd., Norwich.
British Electrical Repairs, Ltd., Birmingham.
British Sangamo Co., Ltd., Ponders End.
British Thomson - Houston Co., Ltd., Rugby.
Brook Motors, Ltd., Huddersfield.
Brown, S. G., Ltd., London, W.
Bull Motors, Ltd., Ipswich.
Bulpitt & Sons, Ltd., Birmingham.

Cable Makers' Association.
Callender's Cable & Construction Co., Ltd., London, E.C.
Canning, W., & Co., Ltd., Birmingham.
Carron Company, Falkirk.
Castle Fuse & Engineering Co., Ltd., Liverpool.
Chloride Electrical Storage Co., Ltd., Manchester.
Clear Hooters, Ltd., Birmingham.
Cleworth, A. B., & Co., Ltd., London, E.C.
Commutator Grinding Block Co., Greenock.
Consolidated Pneumatic Tool Co., Ltd., London, W.
Coventry Chain Co., Ltd.
Credenda Conduits Co., Ltd., Birmingham.
Crossley Bros., Ltd., Birmingham.
Crosthwaite Engineering and Furnace Co., Ltd., Leeds.

Davey, Paxman & Co., Ltd., Colchester.
Davidson & Co., Ltd., Belfast.
Davis & Timmins, Ltd., London, N.
Diamond Fibre Co., Ltd., London, E.C.
Donovan & Co., Birmingham.
Dorman, W. H., & Co., Ltd., Stafford.
Drayton Regulators & Instrument Co., Ltd., West Drayton.

Earle, Bourne & Co., Ltd., Birmingham.
Eastern Telegraph Co., Ltd.
Edison Swan Electric Co., Ltd., London, E.C.
Electrical Power Engineering Co., Ltd., Birmingham.
Electrical Power Engineers' Association.
Ellison, George, Birmingham.
Ever Ready Co. (G.B.), Ltd., London, N.

Fescol, Ltd., London, S.W.
Filtrators, Ltd., London, W.C.
Foster Instrument Co., Letchworth.
Fox & Offord, Ltd., Birmingham.

General Electric Co., Ltd., London, W.C.
Gent & Co., Ltd., Leicester.
Gregson Mfg. Co., Ltd., Birmingham.

Hackbridge Electric Construction Co., Ltd., Walton-on-Thames.
Hailwood & Ackroyd, Ltd., Leeds.
Hawkes, O. C., Ltd., Birmingham.
Herbert, Alfred, Ltd., Coventry.
Hewittic Electric Co., Ltd., Walton-on-Thames.
Heyes & Co., Ltd., Wigan.
Holden & Hunt, Old Hill (Staffs.).
Hollings & Guest, Ltd., Birmingham.
Horstmann Gear Co., Ltd., Bath.

Jackson Electric Stove Co., Ltd., London, S.W.
Johnson, Rd., Clapham and Morris, Ltd., Manchester.
Johnson, R., & Nephew, Ltd., Manchester.
Joyner, Chas., & Co., Birmingham.

Keighley Gas & Oil Engine Co., Ltd.
Lacy-Hulbert & Co., Ltd., Croydon.
Lighting Trades, Ltd., London, E.C.
Lister, R. A., & Co., Ltd., Dursley.
Liverpool Electric Cable Co., Ltd.
London Electric Wire Co. and Smiths, Ltd., London, E.

McGeoch, W., & Co., Ltd., Birmingham.
May & Padmore, Ltd., Birmingham.
Metro-Vick Supplies, Ltd., Manchester.
Micanite & Insulators Co., Ltd., London, E.
Midland Fan Co., Ltd., Birmingham.
Moffats, Ltd., Ontario.
Moorwoods, Ltd., Sheffield.

National Gas Engine Co., Ltd., Birmingham.
Northern Rubber Co., Ltd., Retford, Notts.

Omega Lampworks, Ltd., London, S.W.

Pantin, W. & C., London, E.C.
Parsons, C. H., Ltd., Birmingham.
Peters, G. D., & Co., Ltd., London, S.W.1.
Petters, Ltd., Yeovil.
Pneulec, Ltd., Smethwick.
Pritchett & Gold & E.P.S. Co., Ltd., London, S.W.

Rainsford & Lynes, Ltd., Birmingham.
Ransomes, Sims & Jefferies, Ltd., Ipswich.
Rapid Magnetting Machine Co., Birmingham.
Rawlplug Co., Ltd., London, S.W.
Ray Engineering Co., Bristol.
Reavell & Co., Ltd., Ipswich.
Record Electrical Co., Ltd., Manchester.
Revo Electric Co., Ltd., Tipton.
Reyrolle, A., & Co., Ltd., Hebburn-on-Tyne.
Ringsdorff Carbons, England, Ltd., London, N.W.
Ruston & Hornsby, Ltd., Lincoln.

Shropshire, &c., Electric Power Co.
Siluminite Insulator Co., Ltd., Erith.
Slingsby, H. C., London.
Steam Gauge Mfg. Co., West Bromwich.
Sturge & Baker, Ltd., Birmingham.
Sturtevant Engineering Co., Ltd., London, E.C.

Tangyes, Ltd., Birmingham.
Telegraph Construction and Maintenance Co., Ltd., London, E.C.
Thermo Path Co., Ltd., London, W.C.
Thomas, Bertram, Manchester.
Thor Lamps & Supplies, Ltd., Cardiff.
Timpany & Tylor, Liverpool.
Tucker, J. H., & Co., Ltd., Birmingham.
Turner, Stuart, Ltd., Henley-on-Thames.

Uniflo Pump Co., Fordhouses, Staffs.

Vac-Tric, Ltd., London, N.W.
Vivian, H. H., & Co., Ltd., Birmingham.

Wiggin, H., & Co., Ltd., Birmingham.
Willis & Bates, Halifax.
Wolseley Sheep Shearing Machine Co., Ltd., Birmingham.

Young, Osmond & Young, Ltd., Bexley Heath.

Atomic Layers of Rubidium.

Layers of metallic rubidium, only one atom deep, so thin that several millions would be required to equal the thickness of the paper this is printed on, have been measured at the Bell Telephone Laboratories. Thin films of rubidium, a metal similar to the sodium of common salt, are important because of their use in photoelectric cells.

In the course of researches with a view to making the photoelectric cell more efficient, A. L. Johnsrud measured the thin films. When the film of metal inside the glass cell was very thin it operated better than when thicker. Rubidium can be made into thin films more easily than the related metals, because at rather low temperatures and without loss of time it can be made to evaporate, and the vapour deposited, in a vacuum, to form such a film.

A large photoelectric cell was made and so arranged that rubidium could gradually be deposited on the glass, or else, after a thick deposit had been made, it could gradually be removed. While the film was thus getting thicker or thinner, the photoelectric response (the current given off when light fell on it) could be measured. Since the maximum response was obtained at the same point, whether the film was growing thicker or thinner, it was necessary exactly to record the film's depth.

Ordinary measuring methods proved inadequate, and polarised light was used. When polarised light passes through any film, such as the one of rubidium, the direction in which it vibrates is twisted. The thicker the film, the more it is twisted. By means of another prism similar to that which polarises the light the extent of the twisting, and also the thickness of the film, is measured. The largest current was obtained when the film was but one atom thick.—*Science Supplement.*

D

Legal.

Farnworth v. Manchester Corporation.

THE Court of Appeal, consisting of Lords Justices Scrutton, Lawrence and Sankey, on December 13th delivered judgment on the appeal of Mr. Arthur Farnworth, of Bromyhurst Farm, Barton-upon-Irwell, from the judgment of Mr. Justice Talbot at the Assizes dismissing the action which he brought against the Manchester Corporation for an injunction to restrain the Corporation from so working its Barton power station as to emit fumes heavily charged with sulphur and sulphur compound to the damage of his property and to his health.

The Corporation admitted that a nuisance was created, but contended that as the station was of a kind which Parliament had authorised, Mr. Farnworth could not succeed in his claim.

Mr. Justice Talbot upheld that contention, and gave judgment for the Corporation, but without costs.

Lord Justice SCRUTTON, in giving judgment, said it seemed clear that the station discharged such a quantity of sulphur that fumes mixed with moisture were not dispersed but descended on Mr. Farnworth's land and damaged it. In view of the fact that other large stations were being erected in agricultural districts the legal effect of this was important. Within its own area it appeared clear that the Manchester Corporation was liable for damage by nuisance but it was said that it was not liable outside that area because its powers were obtained by a private Act. He could see no reason why Parliament should make the Corporation liable for nuisance in its area and exempt it from liability for nuisance outside the area. In his view the special Act of 1914 did not vary the operation of the nuisance clause in the general Act, and if the nuisance clause was contained in the Act of 1914 it seemed that the Court was bound to hold that the Act of 1914 did not relieve the Corporation of the liability to pay compensation for damage by nuisance from the station. It was for the defendants to prove that the nuisance was an inevitable result of the working of the station and they had not satisfied him that they had taken all reasonable precautions. He thought the appeal should be allowed with costs there and below up to the present time and judgment entered for the plaintiff for damages up to the present day.

There should also be an injunction to restrain the defendants committing a nuisance by fumes from their generating station, the operation of the injunction to be suspended for a year to enable the Corporation to adopt measures to stop or mitigate the nuisance with liberty to apply after a year for suspension or variation of the injunction. The case showed, added the Lord Justice, the necessity for Parliament and other authorities to give more careful attention to provisions for compensation for damage caused by the enormous development of electrical power stations.

Lord Justice LAWRENCE delivered a dissenting judgment, in which he agreed with Mr. Justice Talbot that the Corporation ought not to be held liable for negligence. The Lord Justice thought the appeal failed and should be dismissed.

Lord Justice SANKEY agreed with Lord Justice Scrutton, and by a majority of the Court, therefore, the appeal was allowed.

Lektophone Corporation v. S. G. Brown, Ltd.

THE hearing was continued on December 11th of the Chancery action by the Lektophone Corporation, Jersey City, U.S.A., against S. G. Brown, Ltd., for an injunction restraining the alleged infringement of a patent for improvements in loud speakers, the complaint being that the defendants had sold a "Mascot" loud speaker which the plaintiffs said was an infringement.

The defendant company denied infringement; it pleaded that the patent was invalid, and counter-claimed for its revocation.

Dr. W. H. ECCLES, the first witness for the plaintiffs, concluded his evidence. He was questioned at great length regarding prior specifications, and his Lordship said he understood that the difference between the alleged infringement and the patent was that the cone in the latter was plano-conical, and in the former it was conical only.

Sir DUNCAN KERLY, K.C., suggested that not one of the loud-speakers which he had put to the witness as having been made under the plaintiffs' licence was made according to the description of the patent in the specification. Dr. Eccles replied that some of them infringed and some were on the border line.

In re-examination, he said it was quite unknown at the date of the patent (1914) that with a large diaphragm or cone one could get low notes more easily. The general nature of the discovery of the original patentee (Hopkins) was that to get loud reproductions by coned diaphragms the edge must be constrained so that it did not vibrate locally, but more as a whole. That was the principle employed by the loud speaker that had been put to him.

Mr. H. A. GILL, a patent expert, on December 12th, said that he had examined a number of loud-speakers, produced in Court, and most of them embodied the principle of the plaintiffs' patent in that they had a cone the edge of which was prevented from vibrating.

In cross-examination he said Mr. Brown's telephone earpiece invention was a great improvement on what had preceded it. The introduction of the thermionic valve and the amplifier had provided any amount of power for the hornless loud speaker, but he did not agree that amplification for loud speakers was introduced by Mr. Brown. He invented and introduced the reed supporting the diaphragm, which was part of the alleged infringement, but not an essential part.

Mr. W. A. DUBUISSON, assistant secretary of the Standard Telephones & Cables, Ltd., gave figures of the sales by wireless manufacturers under patents held jointly by his company and the plaintiffs. In 1927 the Graham Amplion Co.'s sales were 43,108, in nine months of 1928, 26,342; the General Electric Co., Ltd., sold 5,450 in 1927, and 7,866 for nine months of 1928; and the Celestion Co. sold 9,432 from July, 1927, to July, 1928.

Mr. TREVOR WATSON summed up the case for the plaintiffs, and the hearing was adjourned.

On December 13th Sir DUNCAN KERLY, K.C., in his opening statement for the defence, said the case had been presented for the plaintiffs as if the patent in question had had a great commercial vogue, whereas the fact was that it was "dug up" in this country about 1927, and had never been heard of here before that. A great many loud-speakers had been made here, and many of those referred to as embodying the patent did not come within it at all. The real advantages of the loud-speaker were in no way due to that patent. Except as a soft speaker, it was no use at all, except for a gramophone with a large diaphragm, until the introduction of greater power. He submitted that there was no subject-matter in the patent, the idea having been anticipated in earlier patents, three of which were taken out by Mr. S. G. Brown.

Mr. JAMES SWINBURNE said the term "loud-speaker" came into use through the introduction of the valve, and there were still great difficulties of reproduction, as in his view there was distortion throughout the whole process of transmission. The proportion of the bass to the treble became better as the size of the diaphragm was increased.

The hearing was adjourned until December 19th.

Claim for a Lighting Installation.

IN Dumfries Sheriff Court last week evidence was heard in an action by Messrs. Irving & McKinnon, automobile agents and electrical engineers, Lockerbie, against Mrs. Jane Barr, Eaglesfield, for payment of £221 for an electric lighting installation and a motor van. Mr. ALEX. IRVING, the plaintiff, said the whole of the material and work, with the exception of the dynamo and switchboard, were destroyed by fire, and the attitude of respondents right up to the time of the action was that of people who were willing to pay if they could. After the fire they informed him that they would be able to pay as they were getting money from the insurance company. Mr. P. W. HOPKINS, partner in the Magneto Accumulator and Electro Plating Co., Dumfries, stated that he had never encountered a job where the electrical contractors had had to insure the plant or set that they were installing. He considered that all the items charged in the account were moderate, and practically at the retail list price. Mrs. Barr, the respondent, said the dynamo had never been connected to the switchboard, and she complained repeatedly of the way the work was being done. She told plaintiff that when they got the light it would be time to think of paying. The hearing was adjourned.

British Thomson-Houston Co., Ltd., v. Solomon.

MR. JUSTICE CLAUSON, in the Chancery Division, on December 11th, granted the British Thomson-Houston Co., Ltd., an injunction restraining J. Solomon & Sons, and S. Solomon, of Gorleston-on-Sea, Yarmouth, from infringing the plaintiffs' patent for gasfilled electric lamps, an inquiry as to damages, costs, and the delivery up or destruction of the infringing lamps. There was no defence.

North-Western Area Whitley Council.

The annual conference of authorised undertakers in the North-Western Area for the purpose of electing employers' representatives for the ensuing year was held at the Town Hall, Manchester, on December 11th. Alderman T. E. Higham (Accrington), chairman of the District Council, presided, and was supported by Alderman C. Higham (Blackburn), chairman of the District Board. Reference was made to the retirement of Mr. Robert Blackmore in consequence of his having been appointed to a position under the Central Electricity Board. The chairman paid a tribute to Mr. Blackmore for his work on the Council and Board, and moved a resolution expressing the appreciation of the Conference. Mr. Blackmore replied, and expressed great regret at having to leave the organisation. The vacancies caused by the retirement of Councillor A. E. Heaney (Preston) and Mr. R. Blackmore were filled by the appointment of Councillor H. Shepherd (Oldham) and Mr. B. T. Hawkins (Wallasey), respectively. The reports on the work during the past year for both the District Council and Board had been issued prior to the meeting, and were unanimously adopted. The chairman reported that Mr. W. E. Foden, the hon. treasurer, had met with a serious motor accident, and the secretary was instructed to convey to him the sympathy of the Conference and its hope of his speedy recovery.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

"Electrical Review" Index.

The Index to Vol. CIII (for the half-year ending December 31st, 1928) will be published shortly, and we shall be glad to receive the names and addresses of those who require it (free of charge) for binding purposes or wish to retain it for reference. Application should be made as early as possible to the Publisher, 4, Ludgate Hill, E.C.

Large Power Plant Contract.

The large new power station which the Bristol Corporation is constructing at Portishead is to be advanced a stage further in its development by the addition of a 50,000-kW turbo-alternator set, which, together with important extensions to the boiler plant, switchgear and transformer equipment, has just been ordered from the METROPOLITAN-VICKERS ELECTRICAL CO., LTD. The new set will consist of a 51,250-kW turbine driving at 1,500 r.p.m. a main alternator of 62,500 kVA, and a house-service alternator of 1,560 kVA. The turbine will be a two-cylinder machine designed for the existing steam conditions of the station, *viz.*, 300 lb. per sq. in. gauge pressure at the turbine stop valve and from 800 deg. to 830 deg. F. total temperature. The condenser will be of the company's central flow type divided to permit one-half of the tubes to be withdrawn for cleaning while the other half is in operation under light load. The supply of circulating water will be taken from the existing system. The equipment of the set includes steam-operated air-ejectors, feed-water heaters and double effect evaporators, all of the company's manufacture. The new steam raising plant for the extensions includes two water-tube boilers, each of 80,000 lb. per hour normal capacity, together with stokers, forced and induced draught plant, economisers, air heaters, and steam and water pipe-work. The contract also includes extensions to the switchgear and transformer equipment, both at the Portishead station and at the Feeder Road station at the other end of the 33,000-volt transmission lines. The switchgear to be installed will be similar to the metal-clad gear already in service at both stations. The new transformers for Portishead will consist of a 62,500-kVA, 11,000/33,000-volt, three-phase bank of single-phase units, and three 1,800-kVA three-phase units for station lighting. The new transformer equipment, for Feeder Road, will consist of a 25,000-kVA, 33,000/6,600-volt, three-phase bank in single-phase units. The new equipment at both stations will include oil-cooling and handling plant. The whole of the equipment is being supplied to the specification of Mr. H. Faraday Proctor, chief engineer and general manager of the Corporation Electricity Department.

The Scientific Organisation of Work.

The French Government is taking a keen and active interest in the arrangements for the International Congress of Scientific Organisation of Work which is to be held in Paris in June next. These Congresses are arranged biennially by the various National Committees interested in management. The first was held in 1923 at Prague, the second in 1925 at Brussels, and the third in 1927 at Rome. Efforts will be made to obtain papers of real value and interest from Great Britain on this occasion, but only papers dealing with actual and successful re-organisations or reconstructions of businesses will be accepted. The Industrial Management Committee has undertaken to distribute information about the Congress, and anyone interested should write to the hon. secretary of that Committee, 23, Bloomsbury Square, W.C.1.

New Indian Companies.

Among the companies recently formed in India are the Trivandrum Electric Co., Trivandrum, Travancore, with a capital of 20,000 rupees, to carry on business as electricians, and the Shahjehampur Electric Supply Co., Allahabad, United Provinces, capital 1,200,000 rupees.

A Report Upon China.

An extremely interesting review of conditions in China, dated September 1st, has been furnished to the Department of Overseas Trade by Mr. H. H. Fox, C.M.G., Commercial Counsellor at Peking. Mr. Fox, in the course of his report, refers to the uninterrupted growth of China's external trade, which has been looked upon as an indication that things are not so bad as they are painted. He shows, however, that the trade figures do not tell the whole story, and while there is undoubtedly a growing market for British goods, for the time being the demand is restricted owing to the prevalence of civil war, with consequent interruption of communications, a general sense of insecurity, and a variety of minor causes. The report is obtainable at 2s. 6d. net from the Stationery Office; we intend to review it at greater length in a forthcoming issue.

New Catalogues and Lists.

THE VISCO ENGINEERING CO., LTD., 162, Grosvenor Road, S.W.1.—Publication No. 282, giving illustrated particulars of the company's dust collector for grinding machines.

CORNING GLASS WORKS, 501, Fifth Avenue, New York.—A pamphlet advertising "Pyrex" glass power insulators.

THE BRUSH ELECTRICAL ENGINEERING CO., LTD., Loughborough.—An illustrated pamphlet advertising the company's liquid starters.

STANDARD TELEPHONES & CABLES, LTD., Connaught House, Aldwych, W.C.2.—A well-illustrated booklet describing the company's private exchanges and telephone instruments for home, office and factory.

MARCONI'S WIRELESS TELEGRAPH CO., LTD., Marconi House, Strand, London, W.C.2.—Illustrated technical descriptive leaflets: Nos. 1,087 to 1,090 types TN. 1, 2, 4, 5, 5a naval transmitters, and No. 1,092 portable 1-h.p. petrol engine.

METRO-VICK SUPPLIES, LTD., 155, Charing Cross Road, W.C.2.—Two illustrated and priced folders, dealing respectively with "Cosmos" decorative lighting outfits and the "Emvee" patent lampholder.

MESSRS. JOHN SHAW & SONS, WOLVERHAMPTON, LTD., Wolverhampton.—A circular letter, pamphlet and mailing card dealing with the "Trojan" vacuum cleaner. The circular gives details of a "campaign" for the sale of the machine.

THE HOFFMANN MFG. CO., LTD., Chelmsford.—Publication L.C.4, a thumb-indexed catalogue of Hoffmann ball and roller bearings. Each section is fully illustrated and prices are given. In addition there is a great deal of useful data.

THE BENJAMIN ELECTRIC, LTD., Tariff Road, Tottenham, N.17.—The "Benjamin Reflector" for December, containing illustrated notes on the company's industrial and commercial lighting equipment.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—The "Osram-G.E.C. Bulletin" for December, containing illustrated notes on special Christmas lighting and the selling of Christmas presents, as well as articles on "Osram" lighting installations and the company's varied productions.

Recent Contracts.

Messrs. Elder, Dempster & Co., Ltd., have given orders for five of their ships to be fitted with direction-finding apparatus by the Marconi International Marine Communication Co., Ltd. The equipment will be the latest design of marine direction finder, using high-frequency amplifying valves of the screened grid type.

Spanish Tariff Increases.

The *Financial Times* draws attention to a new scale of import duties which the Spanish Government is to put into force on January 1st, 1930. At the same time the Ministry of National Economy has been empowered to modify certain rates applicable to those countries which have treaties with Spain as from the beginning of the New Year. Among the examples of goods affected by the new rates quoted by our contemporary are dynamos, upon which the present rate is 138 gold pesetas per 100 kg. (treaty rate 108 pesetas), the duty on which is to be raised to 150 pesetas per 100 kg. The present duty per 100 kg. for aluminium cable is 44 pesetas (treaty rate 38 pesetas); this is to be increased to 200 pesetas. The duty on internal combustion engines is to be advanced from the existing rate of 24 pesetas per 100 kg. to 130 pesetas. There are, however, instances where the rates will be reduced; this applies to a small extent to steam engines and turbines.

French Import Duties.

The first part of a translation of the French Customs Tariff, showing the "minimum" rates of duty, was published as a supplement to the *Board of Trade Journal* dated December 13th. A second section was to be included in this week's issue.

A Radio Valve Lecture.

The MARCONIPHONE CO., LTD., has prepared a short lecture on the subject of screen-grid valves, illustrated by 18 slides. The company proposes to loan a copy of the lecture and a set of slides to secretaries of radio societies or to members of the trade who wish to lecture before their local societies. A second lecture, on the subject of drawing power from a.c. mains is being produced.

Social Event.

The City of Portsmouth Electricity Department Works Association held a dinner and ball at the Portsmouth Guildhall on December 12th, over three hundred members and friends attending. Mr. B. Handley, engineer and manager, presided, supported by the Lord Mayor and Lady Mayoress (Councillor J. E. Smith, J.P., and Mrs. Smith), Miss Smith, Alderman A. Hemingway, and Councillor W. J. Lewis (chairman and vice-chairman, respectively, of the Electricity Committee), and other members of the City Council. An enjoyable musical programme was rendered, and during the evening the Lord Mayor, on behalf of the employés, presented a clock to Mr. H. Payne and a watch and chain to Mr. George Cootes, who were retiring on superannuation. The Mayoress was presented by the chairman with a cushion, the work of one of the men on the staff.

I.S.B.A. Engineering Section Luncheon.

Sir Ernest J. P. Benn was the principal speaker at a luncheon held at the First Avenue Hotel on Friday, December 14th. Mr. Taffs, who occupied the chair, said that I.S.B.A. might be criticised for inviting publishers to address them, but he was sure that those present were anxious to hear every point of view.

Sir ERNEST BENN, in the course of his speech, suggested that in certain trades production had become almost an embarrassment, and for the next hundred years we should devote ourselves much more vigorously to the sales and distribution side of commerce. He further indicated that advertising people in general seemed to think that advertising was a matter for millionaires and for National Sales Campaigns. He thought that far too little notice was taken of the thousands of smaller manufacturers whose businesses were at best only 50 per cent. developed.

A lively discussion followed, in which a number of speakers took part.

Bankruptcy Proceedings.

E. J. G. HURLES, wireless valve factor, 8, Blackfriars Road, S.E.—This debtor again attended before Mr. Registrar Francke at the London Bankruptcy Court on December 14th for public examination upon accounts showing liabilities of £1,426 and assets, "bad book debts, £598." He was questioned upon the cash and goods accounts ordered by the Court, and agreed that they showed purchases £23,848 and sales £24,248, or a profit of only £400. Counsel appeared for Mr. Armitage, who had been mentioned in earlier proceedings, and denied that there was any foundation of truth in the debtor's statements. Mr. Armitage wished it to be known that none of the transactions between the debtor and himself resulted in a loss to the debtor. The Official Receiver said that the examination showed that the goods sold to Mr. Armstrong by the debtor were at cost price. Counsel said that his client was willing to produce his books for examination. The examination was concluded. The following are creditors:—

	£		£
Beam, Ltd.	41	Metro-Vick Supplies, Ltd.	38
Cossor, A. C., Ltd. ...	59	Mullard Wireless Service Co., Ltd.	246
Edison Swan Electric Co., Ltd.	69	Siemens Elec. Lamps and Supplies, Ltd.	814
Marconiphone Co., Ltd.	130		

F. W. SMITH, 45, Browning Street, Leicester, electrical engineer.—The public examination herein was held recently at the Castle, Leicester. The debtor stated that he had done jobbing work, and would have been able to carry on had a firm not put in a writ in the slack season. He returned a statement of affairs showing liabilities of £121, against assets of £26. The examination was closed.

F. PRICE, TARVER & Co., electrical engineers, 15, Working Street, Cardiff.—Receiving order made December 4th, on a creditor's petition.

G. M. WILSHAW and G. SHARPE (Wilshaw & Sharpe), electrical dealers, 320, Padiham Road, Burnley.—First meeting held December 18th, at the Official Receiver's office, District Bank Chambers, Blackburn. Public examination January 15th, at the County Court House, Burnley.

W. H. WILSON, electrician, Maesyllan Lane, Ruabon.—Trustee, Mr. I. D. Hooson, Official Receiver, St. Paul's Churchyard, The Cross, Chester, released December 3rd.

J. W. TURTON, electrical engineer, Market Place, Banbury.—First meeting December 22nd, at 37, Cornmarket Street, Oxford. Public examination January 18th, Town Hall, Banbury.

L. N. BENNETT, radio engineer, 113, Croydon Road, Caterham Valley, late of Herne Bay.—First meeting December 21st, at 29, Russell Square, W.C. Public examination January 24th, at the County Court, Croydon.

C. H. PEARSON (Pearson & Co. and B.O.A. Engineering Co.), electrical, mechanical and sanitary engineer, &c., 5a, Mosley Street, and Stockton Street, Manchester, and 4, Manchester Road, Hyde.—Application for discharge to be heard January 14th, at the Court House, Manchester.

W. G. HOLMES, wireless and electrical engineer, 43, Walcot Street, Bath.—Last day for proofs for dividend December 28th. Mr. H. Ashton, Official Receiver, 26, Baldwin Street, Bristol.

C. S. HILL (Sanderson, Hill & Co.), electrical factor, Waltham Chambers, Waltham Street, Hull.—First and final dividend of 3s. in the £, payable December 21st, at the National Provincial Chambers, Silver Street, Hull.

Company Liquidations.

TEMPTER, LTD., 8a, Claro Terrace, Earl's Court, S.W.—The first meetings of the creditors and shareholders of this company, which carried on business as dealers in sparking plugs, were held last week at the offices of the Board of Trade, Carey Street, W.C., a compulsory winding-up order having been made on November 12th, upon the petition of a creditor. The accounts filed under the liquidation show total liabilities £683 (unsecured £613); assets valued at £255; and a deficiency of £3,358 with regard to contributories. The failure of the company was attributed to the failure of agents to adhere to the terms of a selling arrangement and to a shortage of working capital. In the absence of any resolutions the Official Receiver was left in charge of the liquidation.

VACUUM LIGHT & POWER CO., LTD.—Winding up voluntarily. Liquidator, Mr. E. J. Tubbs, Devonshire Chambers, Bishopsgate, E.C.

SOUTHEND RADIO CO., LTD.—A meeting of members is called for January 15th, at Stilemans Works, Wickford, to hear an account of the winding up from the liquidator, Mr. C. I. Dornton Duff.

SCARBOROUGH ELECTRIC SUPPLY CO., LTD.—A meeting of members is called for January 11th, at the Pavilion Hotel, Scarborough, to hear an account of the winding up from the liquidators, Messrs. A. A. C. Swinton and W. S. Robinson.

RADIO MAINTENANCE, LTD.—Winding up voluntarily.—Liquidator, Mr. J. J. Middleton, 15, King Street, St. James, S.W.

NEW WILSON ELECTRICAL MANUFACTURING CO., LTD.—Winding up voluntarily. Liquidator, Mr. R. Y. Rickard, 65-66, Basinghall Street, E.C. A meeting of creditors is called for January 2nd, at the offices of the liquidator. Particulars of claims by January 15th.

SCHOLEY & CO., LTD.—A meeting of members is called for January 18th, at 137, Victoria Street, S.W., to hear an account of the winding up from the liquidator, Mr. G. Smith.

MULTIRAY WIRES & ALLOYS, LTD.—Winding up order made by the High Court on December 10th.

NEUTRON, LTD.—Last day for proofs for dividend December 29th. Liquidator, Mr. M. D. Booth, 40-43, Norfolk Street, W.C.2.

NOTABLE ELECTRIC CO., LTD.—Liquidator, Mr. G. D. Pepys, Senior Official Receiver and liquidator, Carey Street, W.C., released November 29th.

Unemployment in Germany.

The Berlin correspondent of the *Financial Times* reported last week that the industrial situation in Germany is beginning to look very serious. In the first place, the number of persons receiving full employment pay from the unemployment insurance companies, which had increased by 134,000 in the first half of November, rose by a further 225,000 during the second half of that month. The dismissal of workers is proceeding much more quickly than at the commencement of last week, and the number of unemployed is now 400,000 more than at the same time last year. The reason for this rapid growth in the army of workless is stated authoritatively to be mainly due to the downward trend of trade in general.

Trade Announcements.

The receiver and manager of Wright Motors, Ltd., Century Works, Halifax, Mr. STANLEY LAYCOCK, announces that he has sold his interest in that business to Messrs. Wright (Electrical Power Specialities), Ltd., who are carrying on the business of motor makers as previously conducted. The claims of debenture-holders have not been wholly satisfied, and amounts owing to unsecured creditors on the date of his appointment by Messrs. Wright Motors, Ltd., also remain unsatisfied.

The Glasgow office and lamp stores of the TUNGSRAM ELECTRIC LAMP WORKS, and of their Scottish agents, Messrs. J. J. INGLIS & Co., have been transferred to more commodious premises in 139a, St. Vincent Street, Glasgow. The telephone number, Glasgow, Central 3360 (private exchange) remains the same as before.

The METROPOLITAN-VICKERS ELECTRICAL CO., LTD., and the METROPOLITAN-VICKERS ELECTRICAL EXPORT CO., LTD., are moving on December 28th from 4, Central Buildings, Westminster, to more convenient offices in Bush House, Aldwych, W.C.2. The Home Sales Department of the Metropolitan-Vickers Electrical Co. at present in "Metrovick House," Charing Cross Road, will move into Bush House on January 7th, but "Metrovick House" will remain the headquarters of Metro-Vick Supplies, Ltd. The new telephone number at Bush House will be "City 1230" (10 lines), and the telegraphic address "Multiphase, Estrand, London."

Messrs. DOWLING & PRIMAVESI, electrical engineers, have removed their offices and showrooms to 14 & 16, New Rents, Ashford, Kent.

A Century of Boiler Making.

An interesting event took place at the Hotel Cecil, London, on Wednesday last week, when the John Thompson Associated Companies celebrated "a century of boiler making" by a dinner and dance. A large number of friends of the companies, including many consulting and central-station engineers, with their ladies, took part in the proceedings, at which Mr. James Thompson, J.P., presided. The entertainment provided was in every way most hospitable and enjoyable;

there were no speeches, but the chairman gave the toast of "The King," and during the evening announced the gratifying news that his Majesty had undergone a successful operation. Mr. A. K. Bruce proposed "Prosperity to the Associated Companies," and the toast was accorded musical honours. Music was provided during the meal, and at 11.30 a cabaret entertainment was given by Mr. Gordon Marsh and "The Marshmallow Girls."

With Messrs. John Thompson, Ltd., are associated Messrs. John Thompson (Wolverhampton), Ltd., John Thompson Water-Tube Boilers, Ltd., and five other concerns with similar titles, as well as the Kennicott Water Softener Co., Ltd.

Health Exhibition at Sheffield.

In connection with the annual congress of the Royal Sanitary Institute, which is being held at Sheffield in July next, a Health Exhibition is being organised. There will be sections including heating, cooking, lighting, ventilating and labour-saving appliances. Particulars can be obtained from the Secretary of the Institute, 90, Buckingham Palace Road, S.W.1.

Agreement Between Important Engineering Companies.

Last week the English Steel Corporation, Ltd., was formed, with a nominal capital of £100, to acquire and amalgamate certain departments of Vickers, Ltd., Vickers-Armstrong, Ltd., and Cammell, Laird & Co., Ltd. The agreements entered into preclude the new company from the manufacture of armaments.

For Sale.

Brighton Corporation Electricity Department invites offers for one semi-automatic Highfield reversible booster set. Taunton Corporation Electricity Department has for disposal condensing plant, 100-kW generator and switchboard, and Belliss & Easton steam engines. (See our advertisement pages to-day.)

Book Notices.

"Industrial Lighting" (151 pp., ill.). Published by the Benjamin Electric, Ltd., Tottenham, N.17.—This is a handsomely-bound treatise of convenient size upon the design and installation of electric lighting systems in factories and workshops of various industries. A great amount of data on the measurement of light, lighting fundamentals, and other relevant subjects is given. Many examples of "Benjamin" lighting fittings are illustrated and described.

"*Journal* of the Institution of Electrical Engineers." Vol. LXVII. December, 1928. London: E. & F. N. Spon, Ltd. Price, 10s. 6d.

"Definitions and Formulæ for Students," "Applied Mechanics." E. H. Lewitt. Pp. iv+36. Price 6d. net. "Practical Mathematics." By L. Toft. Pp. iv+28. Price 6d. London: Sir Isaac Pitman & Sons, Ltd.

Calendars and Diaries.

From the DUSSEK BITUMEN CO., LTD., of Empress Wharf, Bromley-by-Bow, E.3, we have received one of its very high-class pocket note-books and diaries, with insurance coupon, for 1929.

Next year's calendar of the NORTH METROPOLITAN ELECTRIC POWER SUPPLY CO. bears an illustration of the statue on the American Telephone and Telegraph Co.'s building, New York, personifying electricity. As usual the calendar has weekly date slips, each of which bears the month's calendar.

A drawing of the old Parish Church, Leyton, in 1690, appears on the calendar of the LONDON ELECTRIC WIRE CO. AND SMITHS, LTD., Church Road, Leyton, E.10.

Each monthly sheet of the calendar received from Messrs. C. A. PARSONS & CO., LTD., Newcastle-on-Tyne, bears side by side a photographic illustration of the company's plant and an excellent drawing of a building or view in the Newcastle district.

A picture of a gyroscopic compass symbolically placed in a lifebelt appears on the 1929 calendar of Messrs. S. G. BROWN, LTD., North Acton.

A most charming girl forms the subject of the picture on a calendar sent us by Mr. Christopher Wade, director of Messrs. RICHARD WADE & SONS, LTD., Hull. Monthly date slips are provided.

The 1929 calendar of Messrs. LINDSAY & WILLIAMS, LTD., Manchester, is a businesslike production with boldly-figured daily slips.

If the picture, "On the Road to Mandalay," on the calendar of Mr. W. H. SQUIRE, 31, Sweyne Avenue, Southend-on-Sea, is true to life, there seems to be something in the "lure of the East."

Unemployment.

There was a fall of 44,700 in the number of registered unemployed during the week ended December 3rd, although the total remained at over 200,000 above the figure at the corresponding date of last year. The actual total was 1,350,800.

A Christmas Display at West Ham.

The window of the West Ham Electricity Department has been attractively dressed for the Christmas season. The subject of the scheme is "Aladdin Up-to-Date." The hero, in his traditional Chinese costume, is seen in the Cave of Jewels encountering the genie (or genius) who holds an electric lamp. Electric lamps are also freely used in the decorations, and the effect is most pleasing. We regret that a photograph of the window does not do the display justice. Mr. Bridgman, publicity assistant to Mr. F. W. Purse, the borough electrical engineer, was responsible for the work.

Prices of Raw Materials.

Messrs. F. Smith & Co., and Messrs. James & Shakespeare report, December 17th: No change in copper prices.

Messrs. James & Shakespeare report, December 17th: English pig lead £22 10s., 5s. inc.

Messrs. Edward Till & Co. report, December 17th: No change in the price of india-rubber para fine.

In their letter dated December 15th, Messrs. James Forster and Co., stated that the lead market last week had had quite a steady tone, prices fluctuating within narrow limits. Demand from consumers in this country remained very quiet, but on the other hand, there has been no undue selling pressure. There are no signs of a revival in demand on the Continent while in the United States the market is quiet but firm. Under present conditions £21 per ton appears to be about the bottom of the market. Demand may improve after the Christmas holidays, in which event a firmer tendency may be seen in the New Year.

Lighting and Power Notes.

Barnsley.—LOAN SANCTIONED.—The Corporation Electricity Committee has obtained sanction to a loan of £7,356 for mains extensions.

Bradford.—ELECTRICITY SUPPLY.—The Electricity Committee has recommended the extension of the transformer chamber at the premises of J. Ambler & Sons, Ltd., Valley Road, at an estimated cost, including mains, of £4,094. A new transformer chamber is to be installed at Beacon Road, at an estimated cost, including mains, of £4,842. Application is to be made for sanction to the borrowing of these sums.

Brighton.—LOANS.—The Corporation Electricity Committee has recommended that application be made for sanction to the borrowing of £12,200 for the erection of a sub-station at Patcham Place, and £9,317 to defray the cost of the schemes for the lighting of London Road, Dyke Road, and Lewes Road, in place of £8,267 originally proposed.

Bury.—YEAR'S WORKING.—We have received from Mr. J. G. Potts, borough electrical engineer, a copy of his report on the working of the electricity undertaking for the year ended March 31st last. The revenue amounted to £112,356, as compared with £123,717 in the preceding year, and working expenses were £64,197, as against £89,209, and after providing for interest and sinking fund charges, and capital expenditure charged to revenue, there was a net surplus of £5,995, as compared with a loss of £672 in 1926-27. The sales of electrical energy increased from 23,211,588 to 25,270,672 kWh, and the maximum load from 9,900 to 10,840 kW. The average price obtained per kWh fell from 1.279d. to 1.067d. Orders were placed during the year for one 10,000-kW turbo-alternator and two additional water-tube boilers.

Carlisle.—ELECTRICITY SUPPLY.—At a recent meeting of the Corporation Electricity Committee, the engineer reported that, in order to meet the increasing demand in the Stanwix district and to improve the service, it would be necessary to carry out the following works: Feeder from Willow Holme to Hardwicke Circus, £2,400; sub-station and equipment, £300. The Committee is applying for sanction to the following schemes:—Willow Holme Station: Two additional trunk feeder equipments, £1,300; cubicle equipment for trunk feeder, £650. James Street Station: Rotary convertor and switchgear, £5,242; h.p. feeders, between Willow Holme and James Street stations, £2,150.

Continental.—CZECHO-SLOVAKIA.—According to *Commerce Reports*, the Czecho-Slovak Ministry of Finance has approved the construction plans of the long-projected dam to be built at Vranov, on the River Dyje, in Moravia. The work will probably be commenced early in 1929. The dam will be 55 metres high and the reservoir will have a capacity of 161,000,000 cu. metres. The outflow of the river will be regulated to 14 cu. metres per sec. It is estimated that the work of construction will require four or five years and will involve a total expenditure of 112,000,000 crowns, of which about 87,000,000 crowns will be expended on the dam itself and the remainder on the erection of a central power station, with a production capacity of 30,000,000 kWh. The project is under the management of the Ministry of Public Works, Prague.

GERMANY.—According to a recent return issued by the German Society of Engineers there were 607 electric power stations in Germany at the end of 1927, the electricity supplied during that year being 16,168,000,000 kWh. Of the different plants 33.8 per cent. have an annual output not exceeding 2,000,000 kWh, 22.8 per cent. range between 2,000,000 and 5,000,000 kWh, 23.9 per cent. between 5,000,000 and 25,000,000 kWh, 15 per cent. between 25,000,000 and 100,000,000 kWh, and 4.5 per cent. over 100,000,000 kWh.

The Gerstein power station at Stockum a.d. Lippe, belonging to the Eltwerke Westfalen Gesellschaft, is to be extended by the installation of additional plant with a capacity of 50,000 kW. Pulverised fuel will be used for the firing of the boilers.

Russia.—The board of the Supreme Economic Council of the U.S.S.R., has decided that the new power station on the Dnieper shall have turbo-generators of 80,000 h.p. each; six are to be installed at first. The plan is confirmed for the erection of a station for a total of 800,000 h.p. (ten turbo-generators of 80,000-h.p. each). Owing to these changes the opening of the power station has been postponed until December 1st, 1932. The cost is now estimated at £21,310,000, instead of £22,040,000. Various iron and steel works, an aluminium works, chemical factories, &c., are to be built round the station and the Council considers that a line for the transmission of power to the Don coal basin is indispensable.—*Reuter's Trade Service* (Moscow).

Croydon.—Street Lighting.—The Corporation Electricity Committee is to improve the lighting of the recently widened main roads at a capital cost of £2,726.

Dalkeith.—Proposed Purchase of Undertaking.—The Lothians Electric Power Co. has sent a communication to the Corporation inquiring whether it would entertain a proposal to sell its electricity undertaking. The undertaking was acquired by the Corporation three years ago, and a sum of about £30,000 would be involved in the suggested deal. A meeting of the Corporation will be held on an early date to consider the proposal.

Dover.—Loans Sanctioned.—The Town Council has received sanction to loans of £2,280 for feeder mains and £1,520 for a switchboard.

Dumfries.—Loan Sanctioned.—Intimation has been received by the Town Council that the Electricity Commissioners have sanctioned the expenditure of £16,000 for the purpose of providing a stand-by plant to be used in case of emergency. Since the Council's application was made a year ago the Galloway hydro-electric scheme has been outlined, and if that scheme is carried through it will make a substantial difference in the local situation. Accordingly a deputation is to go to London to obtain information regarding possible future developments in the area before the Council finally decides to expend £16,000 on new plant.

Gainsborough.—Electricity in Bulk.—The Electricity Commissioners have approved an agreement between the Urban District Council and the Yorkshire Electric Power Co. for a bulk supply of electricity to the town.

Gillingham (Kent).—Loan.—The Town Council has applied for sanction to a loan of £3,000 for cables, switchhouse and switchgear in connection with the supply to Rainham, Wigmore and Hempstead, for which electricity will be supplied in bulk by the Kent Electric Power Co.

Glasgow.—Refuse Destructor Plant.—Messrs. Heenan and Froude, Ltd., have written to the Corporation explaining the cause of the deficiency in the pulverising plant at the new refuse destructor works at Govan, and the efforts made by them to remedy the defect. They are arranging to replace the existing pulverisers by others of a larger and more powerful type equal to the requirements, and it is anticipated that the works will be ready for use up to the full capacity of the frequency changers on or before February 21st next, and will be ready for the official test on or before April 12th next.

Hastings.—Loans Sanctioned.—The Corporation Electricity Committee has obtained sanction to the following loans: £10,000 for house wiring installations (hire-purchase); £1,000 for purchase of land and works for preparation of a coal dump and extension of railway siding at Broomgrove generating station; £17,997 for mains; and £1,670 for plant (substation equipment and kiosks).

Isle of Man.—Inquiry.—The *Daily Dispatch* reports that the Governor of the Isle of Man has appointed a Commission to inquire into methods of providing electricity generally over the island. The members are:—Mr. Robert F. Douglas (chairman), Mr. John Baxter Clague, and Mr. John McFarlane Kennedy, of Messrs. Kennedy & Donkin. The General Electric Company has instructed advocates to prepare a Bill authorising it to distribute electricity over the whole island, excluding the area already embraced by the Douglas Corporation. The company proposes to purchase the electricity required from the Douglas Corporation. The harnessing of the tides in Calf Sound has been considered, but pronounced impracticable.

London.—Embankment Lighting.—The Highways Committee of the L.C.C. has received offers from electricity supply and gas supply companies for an improved lighting scheme for Victoria Embankment, and proposes to accept the offer of the Charing Cross Electricity Supply Co., Ltd., providing for centrally suspended lanterns over the embankment carriageway at intervals of 140 ft. at a height of 30 ft., each suspension carrying two 1,500-watt gasfilled lamps, and for the necessary cables to be laid under the footway. The estimated cost of the scheme, which has been approved by the Finance Committee, is £14,184.

Liverpool.—Extension of Supply.—In order to give a supply of electricity in the Whiston area, the city electrical engineer proposes that an overhead line be erected from the existing 6,000-V supply at Hunts Cross to the St. Helens boundary at an estimated cost of £16,000. It is proposed to construct this line to be suitable for a working pressure of 33,000 V, and to arrange for sub-stations at suitable points in the area of supply from which the l.p. lines could be extended as demand arises. He also recommends that the 6,000-V supply be extended to Kirkby parish and the Sefton area, the estimated cost, with l.p. mains, being £6,650 and £3,500 respectively. A further sum of £5,000 would be required for sub-station purposes. The City Council is to apply for a Special Order covering these areas.

Llantwit Major.—Inauguration of Supply.—An electricity supply for the district was formally inaugurated on December 11th by the chairman of the Parish Council. Electricity is provided by the South Wales Electrical Power Distribution Co. from the power station at Treforest. An electrical exhibition was held in connection with the event. Supplies to a number of villages between Cowbridge and Llantwit Major will be available shortly.

Manchester.—Progress during October.—During the month of October the Corporation electricity undertaking showed an increase in connections 1,959 kW, bringing the total up to 366,395 kW; and the number of applications received for supply, including those for additional supplies, was 1,643, representing a total of 4,025 kW. The number of hired cookers connected increased by 79, bringing the total actually on circuit to 4,884. Applications for the hire of cookers totalled 86. Three new sub-stations were put into commission, and new plant was installed in two existing sub-stations. The change over from d.c. to a.c. has been completed in the case of 3,056 consumers, and work is in progress, involving 716 consumers.

Otley.—Street Lighting.—At a recent meeting of the Urban District Council last week, in reply to criticisms of the recent decision to change over the whole of the street lighting from gas to electricity, the Chairman of the Council said that the matter had been considered in all its bearings, and one of the biggest faults of gas lighting was that in stormy weather the lights could not be maintained. During a recent gale a tour of the principal thoroughfares revealed that 103 lamps were out. The meeting declined to revise the previous decision to enter into an agreement with the Electrical Distribution of Yorkshire, Ltd., for an electricity supply.

Oxford.—Purchase of Undertaking.—The Corporation has had a letter from the Electricity Commissioners stating that after careful consideration of the representations made by the Oxford Electric Co., Ltd., and of all the circumstances of the case, they have decided to give their consent to the exercise by the Corporation of its right of purchasing the undertaking of the company. The Commissioners feel that by mutual agreement between the Corporation and the company it should be possible, in exercising the right of purchase, to resolve ancillary matters of the kind to which their attention has been directed during the course of the proceedings on the application. The Commissioners are strongly of the opinion that the Corporation and the company should enter into early negotiations with a view to effecting an amicable settlement of these matters.

Portsmouth.—New Pumping Plant.—The Corporation Electricity Committee has had under consideration the question of the installation of a new pipe line and additional pumps in connection with the condensing plant at the generating station, to be in readiness for the winter of 1929. The estimated cost of the proposed new plant is: Buildings, £5,000; pumps, £2,000; motors, £2,000; pipework, £4,000; and contingencies, £1,000.

Stoke-on-Trent.—Loans.—At a recent meeting of the Corporation Electricity Committee, it was decided to make application for sanction to borrow £3,250, the estimated cost of buildings and equipment for the Lichfield Street sub-station, and for £1,600, the estimated cost of the necessary l.p. mains from Lichfield Street sub-station.

Sutton Coldfield.—Electricity Supply.—The Corporation is to apply for approval to proceed with a scheme for supplying the Streetly district with electricity at a cost of £6,500. Application is also to be made for sanction to borrow £4,472 for electricity purposes.

Tonbridge.—Electricity Supply.—The Urban District Council has decided to give a supply of electricity to the works of the Crystalate Manufacturing Co., for power and lighting at a special flat rate of 2d. per kWh, with a minimum of £500 per annum, for a period of five years, as from January 1st next.

Change Over.—The Council has also decided to change over the system of electricity supply from d.c. to a.c., and to apply for sanction to a loan of £21,100 for this purpose.

Watford.—Institution Supply.—The Metropolitan Asylums Board reports that it has had under consideration the question of substituting electric lighting for gas lighting throughout Leavesden Mental Hospital. When it first had this matter under consideration in May, 1927, the engineer-in-chief estimated the capital cost of the installation at £10,250 if the supply of electricity were taken from an outside source. His amended estimate is £11,190. It is proposed to take a supply

of electricity from the Watford Corporation, and the terms offered in May, 1927, were as follows: Lighting, 4d. per kWh; power, 4d. per kWh for the first 8,000 kWh and afterwards 1.11d. per kWh. The engineer-in-chief now reports that as the result of negotiations with the Electricity Commissioners and the local authority, he has received an amended offer under which the maximum lighting rate will be reduced from 4d. to 3d. per kWh and the hours during which this rate will be charged will also be reduced to a minimum. Electricity used outside such hours will be charged for at the power rate. On these terms the annual cost of the electricity consumed is estimated as follows: Lighting, 32,000 kWh at lighting rate, £400, 33,000 kWh at power rate, £131. Power: 90,000 kWh, £382. Total, £913. The Board is of opinion that in view of the alterations to the hospital, which are about to be carried out, the present time is opportune for the introduction of electricity.

Tramway and Railway Notes.

Continental.—BELGIUM.—The electric train service of the Société Nationale des Chemins de Fer Vicinaux, between Charleroi and Montigny-le-Tilleul, has been extended to Bomerée. Several other lines of the company in the Charleroi area are also to be electrified.

London.—HEATING ON TRAMCARS.—The *Daily Telegraph* reports that the Metropolitan Electric Tramways are experimenting with tubular electric heaters for the top saloons of their tramcars. These are fixed along the sides of the car at floor level, and are regulated by a switch on the canopy above the lower saloon doors.

TUBE-CAR EXHIBITION.—The Underground Railway companies commenced on Monday last an exhibition of the progress of tube-car design during the past 38 years: an exhibition train has been stationed at platform No. 4 at South Kensington Station (District Railway). A car, in use on the City and South London Railway in 1890, and an equipment demonstration car are on view. Visitors are allowed to operate some of the equipment themselves. The exhibition concludes tomorrow (Saturday).

Salford.—YEAR'S WORKING.—We have received from Mr. J. S. D. Moffet, general manager and engineer of the city tramway undertaking, a copy of his report, together with the statement of accounts, for the year ended March 31st last. The total revenue amounted to £561,688, and working expenses were £446,917, leaving a gross profit of £114,771. The figures for the preceding year were:—Income, £517,472; working expenses, £454,561; gross profit, £62,901. After providing for capital charges there was a net surplus of £26,298, as compared with a deficit of £13,221 in the preceding year. A contribution of £10,000 was made to the city rates. All the above amounts embody the figures for the motor-omnibus services. The number of passengers carried increased from 81,839,560 to 83,014,398, and the car-miles run from 6,282,208 to 6,540,527. The receipts per car-mile rose from 17.874d. to 18.209d.

REDUCED TRAM FARES.—According to the *Daily Dispatch*, an immediate reduction in tram fares has been decided on by the City Council as the first step in the campaign against the competition of private 'bus companies. From December 13th the maximum fares on tramcars running between Victoria or Deansgate and the outlying districts in the Salford area were reduced from 4d. to 3d. It is expected that Corporation 'bus fares will be reduced in proportion. The maximum fare will probably be the same as on the trams.

Stourport.—PROPOSED ABANDONMENT OF TRAMWAYS.—The Urban District Council has received from the Kidderminster and Stourport Electric Tramway Co., an intimation of an application to the Ministry of Transport to abandon the whole of the system. The consent of the Council is sought, and when the matter came up for consideration on December 5th, the chairman of the Council said that Kidderminster was not in favour of the abandonment of the trams. A committee was appointed to consider the matter and report.

Sunderland.—DOUBLING OF TRACK.—The Corporation has decided to double the present single tramway track over a section of Fulwell Road, at an estimated cost of £4,000, to be borne out of reserve fund.

Warwick.—OBJECTION TO RAILLESS CARS.—The *Birmingham Post* reports that the campaign against the proposal of the Leamington and Warwick Electrical Co., Ltd., to run railless cars in Warwick is continuing, and the General Purposes Committee of the Town Council has authorised the Town Clerk to engage the services of Sir Ernest Hiley as Parliamentary agent, and to consider the question of retaining the services of counsel, in the event of its being found necessary to oppose the Parliamentary Bill which the company is promoting.

Telegraph and Telephone Notes.

Germany.—TRANSOCEANIC TELEPHONY.—The Germany-Argentina wireless telephone service which was opened to public use on December 10th, is stated by *The Times* to be operated by means of land lines from the exchange of the Transradio Company (which holds the concession) to the wireless station at Nauen, and thence by direct transmission with a short-wave sender to the station at Buenos Aires.

AUTOMATIC TELEPHONY.—The telephone system in the town of Ulm a.d. Donau, with about 2,000 subscribers, has recently been converted to automatic operation.

Transatlantic Telephony.—FULL CAPACITY USE.—According to Mr. E. H. Shaughnessy, of the G.P.O., the transatlantic radio-telephone standard of reception is very high and the quality of the speech very often much better than that obtained on long-distance telephone wires. The service, which is available from eleven a.m. until two a.m. the following day, is being utilised to its full capacity, and the original charge of £15 for a three-minute call has been reduced to £9. The majority of subscribers book six-minute calls, evidence that they think it good value for the money. They had placed the receiving station at Cupar, in Fifeshire, he explained, because by experiment it was found that the northern latitude gave much stronger strengths than south, and it was cheaper to pay for the four hundred miles of land line, with repeating stations at different points, than to provide the means for higher amplification at a southern receiving station.

It will be recalled that the service between England and America started in January, 1927, and its extension was commenced in January, 1928; some 13 European countries are now in oral communication with America and the service is available on that side to Canada, Mexico, and the island of Cuba also. All traffic goes *via* the London trunk exchange and the Rugby radio station, which has two circuits: one long-wave and the other short-wave.

The Telephone Service.—YEOVIL P.A.B.X.—Messrs. Petters, Ltd., have installed a private automatic branch exchange of Relay make at their Westland works as a means of establishing intercommunication between some 70 departments, and provision has, of course, been for the switchboard to work in conjunction with the P.O. public exchange also.

POLICE BOXES.—Mr. H. Riches, chief constable of Middlesbrough, recently explained in evidence before the Royal Commission on Police Powers and Procedure, that to compensate for a decrease of his force police telephone boxes had been introduced. The system was extremely valuable, assuming mechanical transport was available to answer calls. The public must be educated to use the telephone boxes in emergencies. He thought that the system had been the means of mitigating crime and that its introduction to the metropolis and other parts of the country would be a great advantage.

It is understood that the authorities at Scotland Yard are to experiment with the system, which is based on those already started in some provincial towns, at once in several districts of Greater London. In many districts of outer London all-night public street telephone boxes are being equipped so that the nearest police station can be called up direct by pressing a red button.

Radio Notes.

Hungary.—RAILWAY ENTERTAINMENT.—A regular radio-telephone broadcast reception service on the Hungarian State Railways was inaugurated in November. For 6d. an hour hygienically wrapped headphones above every seat, including third class, excellently transmit Hungarian and foreign programmes. Headphones in the waiting-rooms at all the Budapest stations are greatly in favour, especially with third-class passengers.

Radio Waves.—VISUAL OBSERVATION.—Prof. Ernest Merritt, of the Department of Physics of Cornell University, at a meeting of the National Academy of Science in Schenectady, N.Y., U.S.A., recently described a "visual method of observing the influence of atmospheric conditions on radio reception." According to the *T. & T. Age*, he has evolved means by which the ground and sky waves, which combine to form the impulses received by a radio station, may be studied separately and visually, and has been applying his method to observe the "fading" of broadcast reception and the erratic changes in the apparent direction of the waves, as indicated by the radio compass commonly used on airplanes. Changes in intensity, phase, and polarisation are indicated by the motion of a spot of light and the changes in the two waves can be followed simultaneously. He uses two radio compasses, one pointed toward the sending station and the other at right angles to that direction; each receiver is connected to one pair of plates of a cathode-ray oscillograph, which produces a spot of light that indicates the ground wave by its horizontal movement and the sky wave by its vertical movement. His method of observation has not been tested long enough to permit of drawing any far-reaching conclusions from the results thus far obtained, but it promises to solve many vexing problems.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Ashford.—January 14th. Electricity Department. One heavy-oil engine to drive a 600-kW alternator, &c. (See this issue.)

Australia. — MELBOURNE. — January 8th. Department of Posts and Telegraphs. Switching equipment and relays. (B.X. 4880)*; fuses, heat coils, and arrestors. (B.X. 4881.)*
January 15th. Telephone transformers. (B.X. 4878.)* Coil posts. (B.X. 4879.)*
January 22nd. Telephonists' telephones. (B.X. 4888.)* Telephone transmitters and parts. (B.X. 4889.)* Telephone receivers and parts. (B.X. 4890.)*
January 29th. Accumulator batteries and counter e.m.f. cells. (B.X. 4906.)*
January 16th. Victorian Railway Commissioners. Rotary convertor or rectifier set for Glen Waverley sub-station. (B.X. 4893.)*
February 4th. State Electricity Commission of Victoria. 11,000-V switchgear for Yallourn power station. (B.X. 4897.)* 11,000-V and 22,000-V switchgear and accessories for Richmond. (B.X. 4898 and 4901.)*
January 14th. 11,000-V transformers and spares. (B.X. 4900.)*
February 4th. Pillar insulators with metal parts, for use on 132,000-V outdoor circuits. (B.X. 4921.)*

Bradford.—January 1st. Education Committee. Electric lighting installations for various schools. City Architect, Town Hall.

Brentwood.—January 21st. Essex and Colchester Mental Hospital Committee. Wiring Brentwood Mental Hospital. (December 14th.)

Edinburgh.—January 14th. Electricity Supply Department. Boiler feed water de-aerating plant. (See this issue.)

Egypt.—CAIRO.—January 24th. Ministry of the Interior. Installation of an electrical system at Beba. (B.X. 4916.)*
January 31st. Diesel engine-driven d.c. generator set, d.c. rotary balancer and accessories for the Kafr El Zayat power station. (B.X. 4931.)*

India.—NEW DELHI.—January 8th. Indian Stores Department. Three 12½-kW oil-engine-driven generator sets. (B.X. 4956.)

London.—CENTRAL ELECTRICITY BOARD.—January 4th, 1929. 132,000-V transformers in connection with the South-East England Electricity Scheme, 1927. (November 2nd.)
ISLINGTON.—January 2nd. Electricity Department. E.h.p. switchgear and accessories. (November 23rd.)
January 18th. One 5,000-kVA and one 375-kVA or one 750-kVA Scott-connected transformers. (November 23rd.)
Materials for 12 months, including cables, meters, transformers, &c. (December 14th.)
LAMBETH.—January 3rd. Board of Guardians. Twelve months' supply of incandescent electric lamps. (See this issue.)
BETHNAL GREEN.—January 14th. Borough Council. Electric lighting and power installations and telephone installation for the public baths and washhouses at Old Ford Road. (See this issue.)

Manchester.—December 29th. Waterworks Committee. Eight sets of electrical operating gear for existing manual sluice valves, Lostock booster station. Specifications from Waterworks Engineer, Town Hall, Manchester. Deposit £1 1s.

Middlesbrough.—December 31st. Education Committee. Installation of electric lighting in 10 Council schools and the Stockton Street Practical Instruction Centre. (December 14th.)

New Zealand. — WELLINGTON. — February 12th. Public Works Department. 110-kV switchgear and controlling equipment for Waitaki electric power scheme. (B.X. 4848.)*
March 5th. Seven 5,500-kVA single-phase transformers. (B.X. 4873.)*
January 29th. Single core, paper-insulated, lead-covered cable. (B.X. 4954.)*
March 18th. 110,000-V transformers (B.X. 4952)*, 11,000-V switchgear (B.X 4953).*
January 29th. 15 sets of earth leakage protection equipment. (B.X. 4950.)*
January 15th. Posts and Telegraph Department. Telephone cords. (B.X. 4847.)* Vitreous enamel phase-indicating plates. (B.X. 4927.)*
February 12th. V.i.r. wire. (B.X. 4951.)*
February 19th. 120,000 galvanised steel spindles for insulators. (B.X. 4948.)*
February 28th. Whangarei Harbour Board. One 15-ton electrically-operated level luffing gantry crane. (A.X. 7263.)*

Salford.—January 4th. Electricity Department. E.h.p. and l.p. lead-covered cables. (December 14th.)

South Africa. — JOHANNESBURG. — January 10th. South African Railways and Harbours. Five electrically-driven traversers and one 5-ton hand-operated overhead travelling crane. (A. 7170.)*
January 24th. Two small d.c. crude-oil generating sets for Maguassi. (B.X. 4943.)*
February 14th. One 15-ton electrically-driven portal titan crane. (A.X. 7272).*
GRAHAMSTOWN.—January 22nd. Municipal Council. Cables, transmission lines and transformers. (B.X. 4913.)* Centrifugal pumps, motors and cables. (A.X. 7187.)*
PRETORIA.—January 24th. Posts and Telegraphs Department. Telephone switchboards. (B.X. 4912.)*

Southend.—December 31st. Light Railways and Electricity Department. 3,000 joint boxes (November 30th.)

Stafford.—December 28th. Education Committee. Installation of electric light and power in the County Mining College, Cannock. (December 7th.)

Stoke-on-Trent.—January 16th. Electricity Department. L.p. d.c. switchboard; e.h.p. ironclad switchgear. (December 7th.)

Turkey.—CONSTANTINOPLE.—January 5th. Posts, Telephones and Telegraphs Department. 60,000 porcelain insulators and 15,000 swan neck fittings. (B.X. 4904.)*

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Birkenhead.—Health Committee. Accepted:—
Replating storage battery at Thingwall Sanatorium (£147).—Tudor Accumulator Co., Ltd.

Bradford.—Housing Committee. Accepted:—
Electric lighting installations.—Shops, &c., on Shirley Manor Estate, four shops and houses, £12 18s. 11d. per house and shop, Mr. J. Carter; six houses and shops, Eccleshill Estate, £11 10s. per house and shop, Mr. F. Draycott.
Tramways Committee. Accepted:—
Twenty steel axles for tramcars (£130).—Brown Bayleys Steel Works, Ltd.
Electricity Committee. Accepted:—
Unit type switchgear for Valley Road power station.—Parmiter, Hope & Sugden, Ltd.
Automatic combustion control for two boilers at Valley Road power station.—James Gordon & Co., Ltd.

Dartford.—Urban Council. Accepted:—
H.p. cable for Havelock Road (£777).—Johnson & Phillips, Ltd.

Douglas (Isle of Man).—Electricity Committee. Accepted:—
Steel work for power station (£4,506).—Young & Co.

Dover.—
Electrical installation at the New Plaza Cinema.—E. Wright.
Town Council. Accepted:—
Switchboard for the electricity works (£530, plus £110 for protective gear).—Switchgear & Cowans, Ltd.

Glasgow.—Health Committee. Recommended:—
Electric lighting installation at Knightswood Hospital (£351).—H. T. Boothroyd, Ltd.
Watch and Lighting Committee. Recommended:—:
1,000 lanterns (£1,487).—Revo Electric Co., Ltd.
Tramways Committee. Recommended:—
Insulated bolts.—British Insulated Cables, Ltd.
V.i.r. cable.—Felten & Guilleaume.
Switchboard for new 'bus garage.—Mavor & Coulson, Ltd.

London.—WANDSWORTH.—Board of Guardians. Accepted:
Cable and electrical sundries for St. James' Hospital:—
Cable (£163).—India-Rubber, Gutta Percha and Telegraph Works Co., Ltd.
Sundries.—Wm. White & Co., Ltd.

PADDINGTON.—School Managers. Recommended :—
Additions to the electric lighting installation at St. Stephen's School.—Haine & Co. (£277).
ST. PANCRAS.—Contract and Stores Committee.
L.p. cable (£968).—Greenwich Cable Works, Ltd.
HACKNEY.—Electricity Committee. Recommended :—
One 30,000-kW turbo-alternator and condensing plant (£101,052).—C. A. Parsons & Co., Ltd.
E.h.p. switchgear (£56,045).—A. Reyrolle & Co., Ltd.
LONDON COUNTY COUNCIL.—Highways Committee. Accepted :—
Track rails (£55,381), bolts and nuts (£1,075), and slot rails (£4,846).—Dorman, Long & Co., Ltd.
Conductor rails (£10,464).—Frodingham Iron & Steel Co., Ltd.

Stoke-on-Trent.—Electricity Committee. Accepted:—
Overhead wiring and services to 64 houses on the Sutton estate (£185).—Barnett & Soans.
Additions to electric coal-handling plant (£150).—John Booth & Bros., Ltd.
Highways Committee. Accepted :—
Electric lighting at Copeland Street stores.—A. Bew (Burslem).

Torquay.—Town Council. Accepted :—
Overhead 11,000-volt three-phase line from Ipplepen to Dartington.—Johnson & Phillips, Ltd.

Wolverhampton.—GREAT WESTERN RAILWAY.—Accepted :—
Installation of electric lighting in offices and stores at Stafford Road works.—Walter Parkins & Co.

Forthcoming Event.

British Electrical Development Association.—Friday, December 21st. Royal Society of Arts, John Street, Adelphi, W.C. 7.30 p.m. "Hire and Hire-Purchase in Electrical Development Schemes." Mr. J. E. Tapper.

Notes.

Early Electrical Literature.

With more than half a century of electrical history behind us, there is in existence a vast store of literature, some of which is of great value to the historian and the biographer. It is very desirable to preserve interesting old documents from destruction and to render them accessible for future reference. With this in view, Mr. Killingworth Hedges, who has played no small part in the development of the electrical industries, informs us that he possesses a variety of directories, catalogues of exhibitions, papers, and articles dating from 1879 onwards, and now out of print. In the list of these, which is in our possession, we notice the catalogue of the Crystal Palace Exhibition of 1882-3; Hopkinson's lectures on "Electric Lighting," with the author's compliments (1883); K. Hedges' early works, including "Practical Electric Lighting" (1879), "Systems of Electric Lighting" (1880), and "Supply of Electricity by Local Authorities" (1883), as well as other interesting items. Mr. Hedges offers these for sale on very moderate terms, for the benefit of the West London Hospital, to which he will give any sums that are received—a seasonable proposition which should appeal to our readers.

The Smithfield Show.

A few items of electrical interest were included in the exhibits at the annual show of the Smithfield Club held at the Royal Agricultural Hall, Islington, last week. Messrs. Petters, Ltd., showed for the first time their new "Auto-Petter-Light" electric light plant. This is a self-contained set, without storage batteries, which should prove useful for the lighting of bungalows, summer houses, and other places where light is required for relatively short periods, and a storage battery would be liable to be out of use and unattended for long periods. The set is automatically controlled, but it can also be started and stopped by means of a switch placed in any part of the house. A centrifugal governor regulates the consumption of petrol in proportion to the number of lamps in use. The automatic features have not, it is claimed, been introduced at the expense of the life and efficiency of the plant, and all unnecessary complications have been avoided. There is no switchboard and no delicate control mechanism is employed. The plant consists of a Petter two-stroke water-cooled engine fitted with a self-starter similar to that used for an ordinary motor car, directly coupled to a compound-wound dynamo. A 12-V starting battery is kept fully charged by the starter generator. The set is made in three sizes, 700, 950, and 1,450 W, 110 V. It can be supplied for other voltages if desired.

New small electric lighting and power sets were shown by Messrs. Blackstone & Co., Ltd., in addition to Blackstone spring-injection heavy-fuel-oil engines. A 1½-kilowatt petrol-electric generator set shown consists of a 3½-b.h.p. Blackstone 4-stroke petrol engine directly coupled to a dynamo and mounted on a common baseplate. A switchboard is mounted on the dynamo. Similar sets can be supplied for 1, 2½, and 3½ kW outputs. Messrs. R. A. Lister & Co., Ltd., showed a new cream separator, the "Lister Minor," equipped for electric driving. The machine is of the table-model type and is available in capacities of 11 and 15 gal. Suitable motors, a.c. and d.c., for electric driving on the farm were shown by Messrs. Ransomes, Sims & Jefferies, Ltd. Included in the machine-milking equipment displayed at the show was the "Alfa-Laval" plant of the Alfa-Laval Co., Ltd. This equipment is particularly suitable for electric driving. Two generating sets were exhibited by Messrs. Clayton & Shuttleworth, Ltd. One of these, a 15-h.p. semi-Diesel oil engine, will work, it is claimed, on any marketed brand of oil fuel. Electrically driven sheep-shearing machines were shown by the Wolseley Sheep Shearing Machine Co., Ltd. Messrs. Boulton & Paul, Ltd., showed a compact 1½-kW "Electolite" house lighting set, and also an electrically driven self-oiling domestic pump.

Experiments on Belting.

Important data regarding power transmission by various types of belting were given by Dr. H. W. Swift in a paper, "Power Transmission by Belts; an Investigation of Fundamentals," read before the Institution of Mechanical Engineers on November 16th. The author dealt exhaustively with experiments carried out to measure the loss of speed in a running belt in comparison with the creep computed from the stress-strain relationship of various types of belting—leather, cotton, hair, balata, rubber and compound. In each case the results of the tests record the action of a 2-in. belt from ordinary stock, run at a uniform speed of 1,000 ft. per min. over polished cast-iron pulleys 20-in. in diameter—4½-in. face. In some cases the incidence of general slip was well defined, and the effective tension reached a definite limit beyond which, under the existing mean tension, it could not rise. In other cases, more especially with leather belts, the maximum was not well defined, and a considerable increase in power was possible after bodily slipping commenced. These general observations, the author said, agreed with the results of the Friedrich tests. In connection with tests on fabric belting, the most striking feature was the difference in performance found between two woven hair belts which were used. This showed that the methods of manufacture and preparation were important factors, and that there might be as much difference between examples of a single class of fabric belt as between the classes themselves. Rubber-covered belts seemed to suffer a permanent loss in their frictional property after a period of bodily slip. Balata belting, on the other hand, gave a somewhat higher coefficient of performance for a time after it had first become warmed by slip, due, no doubt, to the partial exudation of the balata gum. This improvement was not maintained, however, and after a longer period of running the coefficient fell to its original value, and no similar improvement occurred in subsequent tests.

Talking Kinematographs.

A Luxemburg scientist living near Paris has recently completed an intricate, but apparently practical, device for the transmission of moving pictures by wireless, says *Commerce Reports*. While the transmission and reprojection of films by wireless has already been accomplished by various means, in the present instance the size of the image transmitted is not limited; in fact, the perfection of the image reproduced increases with the size of the screen. The use of a positive film is eliminated, the transmission being accomplished by using the negative film direct, obviously an important consideration from the point of view of the rapidity with which pictorial news items, for example, could be displayed. The transmission and reproduction of the film do not necessarily take place at the time the negative is projected into the apparatus: the impression of the film is electrically transmitted and magnetically conserved (on a series of fine metallic ribbons) in such manner as to permit its subsequent wireless transmission for exposure on the screen, or screens, either immediately or at a later time. The conservation of the intermediate magnetic impression being more or less indefinite, the wireless transmission of the picture can be repeated without further recourse to the original negative film. The registration of sound can be accomplished simultaneously with that of the moving picture itself, so that talking films can be projected into the device, magnetically conserved, and transmitted by wireless for reproduction.

Exhibition of the Physical Society and the Optical Society.

The nineteenth Annual Exhibition of the Physical and Optical Societies is to be held on January 8th, 9th and 10th, 1929, at the Imperial College of Science, South Kensington, in the afternoon, from 3 to 6 p.m., and in the evening from 7 to 10 p.m. Over 80 firms have accepted the invitation to exhibit in the Trade Section at this exhibition, and a group of research and experimental exhibits is being arranged, which will be shown by Fellows of the Societies and others. Some interesting historical exhibits will also be included. The discourses, which will be given at 8 p.m. on each evening, are as follows :

On January 8th—Professor F. Lloyd Hopwood, M.A., F.Inst.P., "Experiments with High-frequency Sound Waves."

On January 9th—Mr. Conrad Beck, C.B.E., "Lenses."

On January 10th—Mr. A. J. Bull, M.Sc., F.Inst.P., "Some Colour Problems in Photo-Engraving."

We understand that invitations to the exhibition have been sent to the Institution of Electrical Engineers, the Institution

of Mechanical Engineers, the Faraday Society, and other societies; members of these societies should apply for tickets to their secretaries. Others may obtain tickets on application to the Secretary, the Physical and Optical Societies, 1, Lowther Gardens, Exhibition Road, London, S.W.7. Tickets are required only on January 8th and 9th; admission on the third day, January 10th, will be without ticket.

Local Societies.

Mr. S. E. Britton, city electrical engineer, Chester, recently gave an address to the Chester Young Farmers' Club on "Rural Electrification."

Mr. J. A. Robertson, of Manchester, presided at the hot-pot supper and smoking concert of the Manchester and District Electro-Harmonic Society on December 14th, when several of the members of the Liverpool Society were entertained.

A meeting of the Paisley Association of Electrical Engineers was held on November 21st, when Mr. J. S. Kilpatrick, of the Corporation Electricity Department, gave an interesting paper on "Heating by Electricity."

The report for the 1928 session of the Birmingham Electric Club shows a total membership at the end of the session of 224. The income for the period was £296, resulting in a balance over expenditure (including investment) of £106.

Rural Reconstruction.

A conference on educational policy in its relation to rural reconstruction, convened by the Rural Reconstruction Association (one of the many objects of which is the stimulation of the distribution of electricity throughout the whole of the countryside and new industrial centres) and other interested bodies, took place at the London School of Economics on November 10th.

Dr. Gilbert Slater, M.A., D.Sc., chairman of Council, R.R.A., presided over the morning session, and Sir Michael Sadler over the afternoon session, and amongst the subjects discussed "The Decentralisation of Industry" was dealt with by Councillor A. T. Pike, secretary of the Garden Cities and Town Planning Association, who described, *inter alia*, the efforts that are being made to revive rural industries and the important influence which the availability of supplies of cheap electricity exercises in that connection.

"Rural Electrification" was expounded by Mr. R. Borlase Matthews, Wh.Ex., A.M.Inst.C.E., who contended that electricity made rural reconstruction possible. From an engineering point of view, rural electrification was a feasible proposition, though a revision of distribution methods and the introduction of an intermediate high pressure (of, say, 3,300 volts) was essential.

In conjunction with Dr. A. Ekström, a leading Swedish expert, he had recently prepared a scheme, and applied for a Special Order, for the rural electrification of the greater part of the County of Lincoln (see ELEC. REV., October 26th, p. 736, and November 30th, p. 960, 1928), the first time an attempt had been made in this country to provide an adequate supply in a rural area along the lines of established practice in other countries. It was proposed to supply practically every town, village and hamlet in the county.

Appointments Vacant.

Assistant power station superintendent (£500) for the Government of Ceylon Electrical Department. Electrical fitter for the Stepney Electricity Supply Undertaking. Chief repair shop and maintenance foreman (Rs. 750 per month) for the G.I.P. Railway. Mains superintendent for the Borough of Stockport Electricity Department. One telephone traffic engineer and two installing engineers for the Shanghai Mutual Telephone Co., Ltd. (See our advertisement pages to-day.)

A Large Coal-handling Plant.

An extensive coal-handling and storage plant which has recently been installed by Messrs. Edward Bennis & Co., Ltd., at the Newton Abbot generating station of the Torquay Corporation, presents some interesting features. A new elevated siding has been built from the railway to a plot of vacant land lying between the River Lemon on one side and the Whitelake on the other side. After being weighed, the trucks are tipped by a "Bennis" rotary truck tipper, and the fuel is dumped into a receiving hopper from which it passes into a system of conveyors which deliver it, either into the coal-storage bunker, or direct into the boiler-house bunkers. The new plant will convey the fuel at a rate of from forty to fifty tons per hour, continuously, and normally only requires the constant attendance of one man. The new siding is built entirely of ferro-concrete, and carries a single line of track with a walking space and handrails at each side. It has a total overall length of 215 ft. Electric capstans and bollards are fixed at suitable points to facilitate the movement of the trucks after they have been disconnected from the locomotive. After all the trucks have been tipped they are worked back by the capstan through the tipper up to the boundary gate, ready for the locomotive to take them away. The rotary tipper is fitted with hand-clamping gear and operated by an electric motor. Leaving the receiving hopper the fuel flows into a "Bennis" U-link chain conveyor, which carries it through a horizontal distance of about 420 ft. and elevates it through a total height of about 70 ft. in the same operation, and at the rate of fifty tons per hour. It passes over the top of the 1,000-ton storage bunkers, and discharges the coal either into a similar conveyor, No. 2, or into the storage bunkers, at will. The driving gear of this and also of No. 3 conveyor, and the tension gear of No. 2 conveyor, together with the motors, are all placed in a chamber built at a height of 70 ft. above the ground level and carried on the top of a mild-steel tower placed at the junction between the three conveyors. The total distance through which the coal is conveyed after it leaves the railway trucks and before it reaches the extreme end of the conveyor system is about 620 ft., and it is elevated through a total height of about 70 ft. whilst in transit. The conveyors are designed to run at full speed or half speed. The storage bunker is 86 ft. long by 20 ft. wide by 40 ft. high to the conveyor level, and is built throughout of reinforced concrete, with a concrete housing and roof over the top of the bunker. Outlets are provided in the bottom of the bunker through which the fuel flows by gravity through suitable valves into No. 3 conveyor. When taking the fuel from the storage bunker, it is passed into a retrimming conveyor, No. 3, of the "Bennis" U-link tray type, which carries the coal either horizontally or up any angle of incline up to about 60 deg. with equal facility. All the conveyors are driven by separate electric motors, controlled by contactor gear, which is interlocked and so designed that by pressing push buttons the conveyors automatically start up or stop, as desired, in pre-determined sequences.

Coal-handling Plant at the Newton Abbot Generating Station of the Torquay Corporation.

E.A.W. Activities.

Members of the Electrical Association for Women evening classes welcomed for the first time on December 10th Col. Vignoles, director, Electrical Development Association, who lectured on "Safety in the Electrical Home." He described in a simple way accidents which could occur through shock and fire in connection with faulty installations, and made special reference to the need for insulation and earthing in the bath-room.

At a meeting of the Manchester District Branch of the Association on November 23rd, Mrs. Flack spoke on "Electric Appliances and Their Uses in the Home." On December 5th a visit was paid by members of the same branch to the showrooms of Messrs. Frigidaire, Ltd., where Mr. F. Jones gave an instructive address on "Automatic Electrical Refrigeration."

Lighting an Australian Air Mail Route.

A contract has recently been entered into between the Australian Federal Government and West Australian Airways, Ltd., for the establishment of an aeroplane service between Perth and Adelaide for the carriage of mails. The scheme is

the first of its kind to be established in Australia, and a West Australian firm, H. C. Little & Co., Ltd., electrical engineers and contractors, of Perth, who submitted a complete scheme of lighting the route for night flying, has secured the contract. Beginning at the Maylands aerodrome, near Perth, the whole distance to Cook, an air journey of 913 miles, will be illuminated. The aerodromes and landing grounds will be flood-lighted, and the route between them marked by powerful beacons, throwing beams of 3 million candle-power, visible within a sixty-mile radius. Hangars and rest houses will have their roofs and sides illuminated with Benjamin reflectors and ½-watt type lamps, so that they will be in clear relief. The landing grounds will be lighted by twenty G.E.C. field-flood lamps placed on adjacent sides of the grounds; they provide 60-million candle-power, half of which will be used for landing purposes, the other half being available for contingencies. An illuminated wind-direction indicator will also be installed at each landing ground. The fifteen revolving beacons at intervals throughout the route will be of the Sperry 24-in. type, with two lamps, each of 1,000 watts power; one lamp only will be used, the other being in reserve and so arranged that it will be automatically switched into service by means of thermostatic mechanism. At Perth and Kalgoorlie electricity will be supplied from the local power plant, but at Forrest self-contained plant will be established, comprising two 45-h.p. Petter crude-oil internal-combustion engines driving 25-kW English Electric generators. One set in each case will provide all the power required, the other being in reserve. At Forrest another 8-h.p. engine and 4½-kW generator will be installed for the lighting of workshops, the hostel, and other buildings. Except at two places, the electricity for the beacons will be drawn from local supplies between Perth and Kalgoorlie; in the other cases self-contained plant will be employed. The beacons will be mounted on top of 20-ft. steel towers, and will revolve six times per minute. At the base of each will be housed a 5-h.p. Petter kerosene engine and 3-kW generator and batteries. On each side of each beacon on the ground will be placed large direction letters of metal. "E" on the east side and "W" on the west, flood-lighted by Benjamin reflectors and ¼-watt type lamps fixed half-way up the beacon towers.

Fatalities.

An inquest was held in Birmingham on December 6th into the cause of the death of Arthur Walton (53), departmental manager at the electrical accessory works of the General Electric Co., Ltd. It was stated that Walton stumbled over a loose block in the floor and fell, breaking his right thigh. No report had, however, been made to the management of any defect in the floor, which it transpired was in one place slightly higher than the normal. A verdict of "Accidental death" was returned.

Robert Strang (25), an electrician employed at the Riddochhill Colliery of Messrs. William Baird & Co., Ltd., on December 11th, received a fatal electric shock while executing repairs in the power station. It is stated that he came into contact with a 3,000-V conductor.

Whilst undergoing an X-ray examination at Hull Royal Infirmary on December 14th, Doris Laverick, aged 8, received a fatal electric shock. The child was being treated for a fracture of the arm, and was lying on the operating table when a flash occurred, and a strong electric current passed through the body of the nurse to the child and from the child to the mother, who was standing at the head of the table. The doctor received a shock when he picked up the child. The nurse was severely burned.

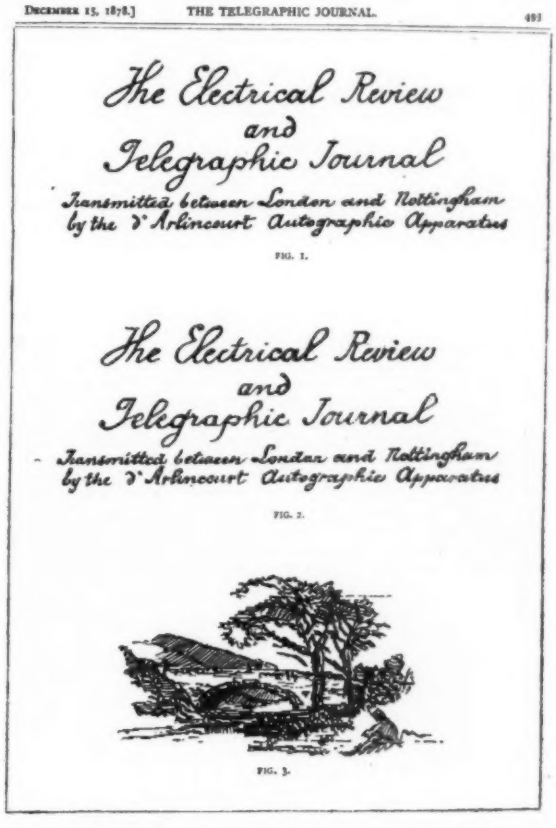
Report on Newport Undertakings.

In our issue of November 9th (p. 807) we summarised a report by a chartered accountant upon an investigation into the administration of the various departments of the Newport Corporation, in which criticism of the electricity and tramway undertakings appeared. The general manager of these departments (Mr. N. J. Young) and the borough electrical engineer and tramway manager (Mr. A. Nichols Moore) have produced a lengthy reply to the criticism. In the course of this it is maintained that the present joint management of the two undertakings is efficient and harmonious and less costly than two separate administrations. To the suggestion that the policy of the department is not sufficiently far-sighted, it is replied that a scheme providing for a period of five years was laid down by the borough electrical engineer in March last. It is denied that the department is over-staffed; a number of smaller undertakings carry a similar personnel. The system of supervision is held to be adequate, and the waste of time alleged by the investigator is said to be pure inference from a few casual visits. The investigator's reference to Mr. Nichols Moore's election as president of the I.M.E.A. is regretted, in view of the national importance of the position and the fact that Newport must be prepared to take its full share of the Association's work. Further, the engineer has sacrificed a considerable part of his annual leave, and has consistently worked late, for the good of the department. Exception is taken to the visit of a "technical expert" during the absence of the two chief officials, who were not given an opportunity of meeting him. It is shown that the retention of the Llanarth Street station as a generating station was dictated by the shortage of circulating water and boiler capacity at East Street. Generating ceased there, however, in March last, but a small staff has been retained as a matter of security. It is shown that the delay in bringing the East Street station up to date was due to a number of causes beyond the control of the department. Later, it is stated that if proper economy in extensions is to be observed, it is desirable not to budget too far ahead. Other sections of the reply are devoted to refuting statements that the department is over-capitalised; that the coal-handling plant is not up-to-date, that the purchasing system is unsatisfactory, and a number of other matters.

Telewriting in 1878.

The transmission of handwriting and illustrations by electricity is popularly regarded as a product of the 20th century; it was, however, one of the earliest objects of attention on the part of inventors, dating back at least as far as 1842, when Alexander Bain devised his "chemical telegraph." Five years later, Bakewell developed apparatus which was actually for a time in commercial operation, and Caselli and others worked on the subject in later years.

About half a century ago d'Arlincourt invented "autographic telegraph apparatus" which worked very efficiently, and was operated over the Postal Telegraph lines with success. In the TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW of December 15th, 1878, facsimiles of messages transmitted between London and Nottingham were printed on p. 495, which we reproduce herewith (about two-thirds the original size). Fig. 1 shows "the writing as it appears when executed


DECEMBER 15, 1878.] THE TELEGRAPHIC JOURNAL. 495

The Electrical Review and Telegraphic Journal

Transmitted between London and Nottingham by the d'Arlincourt Autographic Apparatus

FIG. 1.

The Electrical Review and Telegraphic Journal

Transmitted between London and Nottingham by the d'Arlincourt Autographic Apparatus

FIG. 2.

FIG. 3.

in ink on the transmitting paper. The ink employed is of the ordinary writing description, with a little gum added, the paper being of the kind employed generally for wrapping up tea in, that is, paper silvered on one side. Fig. 2 shows the writing as it appears on the receiving paper, the impressions being actually of a dark blue colour." Fig. 3 shows the received copy of a sketch similarly transmitted.

In our issue for January 15th, 1879, the d'Arlincourt apparatus was described and illustrated; the system was generally similar to that of Bakewell, with synchronising mechanism of his own invention. It will be seen that a considerable measure of success was attained, very little distortion being observable in the writing received. The inversion of the order of the two titles of the journal is a singular feature of the illustration.

The Institute of Metals.

The Council of the Institute of Metals has found it necessary to alter the date of the 21st annual general meeting and "coming-of-age" celebrations of the Institute, from that originally announced (March 6th and 7th) to March 13th and 14th next. In addition to a dinner and dance at the Trocadero on March 13th, an interesting function is being arranged for the second day of the meeting in the form of a conversazione and exhibition to be held in the Science Museum, South Kensington. Objects of special interest in relation to the work of the Institute will be displayed, and offers of such objects are invited and should be made to the Secretary, Mr. G. Shaw Scott, M.Sc., 36-38, Victoria Street, Westminster,

S.W.1. The annual May lecture of the Institute is to be given on May 7th by Sir Oliver Lodge, F.R.S. The annual autumn meeting will be held in Düsseldorf next September.

Association of Public Lighting Engineers.

At a recent meeting of the Council, at Birmingham, the decease of Mr. Noah Wright (president-elect) was reported, and received with regret. Steps were taken to fill the vacancy, the choice falling unanimously on Mr. S. B. Langlands, J.P., of Glasgow, the first president of the Association. The Council decided to hold its next annual meeting and conference at Bournemouth under the presidency of Mr. Langlands, and to hold an Exhibition of Public Lighting Appliances in connection therewith. The date will be September 9th to 12th, 1929. Firms wishing to participate in the Exhibition should notify the Hon. Secretary, Capt. W. J. Liberty, 68, Victoria Street, London, S.W.1. The Council likewise decided to hold a general meeting of the Association at the British Industries Fair at Birmingham during the third week in February, 1929. Mr. Robert Beveridge, lighting inspector, City of Edinburgh, was added to the Council in the place of the late Mr. Wright.

Electric Vehicles in Public Service.

At a meeting of the Institute of Public Cleansing held at the Royal Agricultural Hall on November 24th, in conjunction with the Public Health Exhibition and Congress, a paper was read by Mr. J. Jackson (general manager of the Birmingham Corporation Salvage Department) on "The Place of the Electric Vehicle in the Cleansing Service." During the subsequent discussion Alderman W. G. Davey (East Ham) said that for refuse collection he would unhesitatingly give his vote for the electric vehicle, which, he believed, if properly supervised and developed, would beat the petrol vehicle for that purpose. Mr. H. Ardern said that in Blackpool he could collect more cheaply with electric vehicles than with horses on the shorter distances, say up to 2½ miles. He had not found that stand-by plant was necessary where the energy was obtained from steam provided from the refuse destructor. In Sheffield he had 75 electric vehicles and he kept them going without any outside electricity. He thought the chassis of electric vehicles could be improved. Mr. J. T. Nutter (Nelson) said he had one 2-ton electric wagon which collected an average weight of 5 tons 5 cwt. per day at an average cost of 15s. 3.2d. per ton, whereas two horses working in the same district with the same four men collected an average weight of 5 tons 18 cwt. at a cost of 12s. 7d. per ton. Mr. Capon (Epsom) said that on a test recently under the same conditions it was found that an electric vehicle did the work slightly cheaper than a petrol vehicle, and both were cheaper than a horse. Mr. Douglass (Hull) said that in some tests that had been carried out between a modern electric vehicle and a horse-drawn vehicle, the figures per ton collected were 7s. 8d. for the electric vehicle and 6s. 8d. for the horse. Mr. Jackson, replying to the discussion, said that at one of his works he had gone along quite successfully without any stand-by supply. On the other hand, if he could make a bargain with the borough electrical engineer for a stand-by supply on good terms he would certainly take it.

Educational.

The annual report for the 1927-28 session of the Royal Technical College, Glasgow, is now available. The total number of students in attendance during the session, 4,169, was exactly the same as in the 1926-27 session. There was an increase in the "student-hours" of actual work and attendance in both the day and evening sections. There was a total expenditure of £76,149 for the year under review, and a deficit of £182.

Institution Notes.

Institution of Electrical Engineers.

INFORMAL MEETING.—At the informal meeting held on December 10th (Mr. W. E. Rogers in the chair), Mr. E. W. Dorey opened a discussion on "Power Factor Tariffs and Methods of Metering." He said the improvement of power factor was receiving more consideration than ever, but it was very desirable that some unanimity of opinion should be arrived at as to the most suitable form of tariff and the best method of metering for it. Up and down the country all imaginable forms of tariffs for power loads were in operation, and it was difficult to understand why an industry of the importance of electricity supply could not devise methods of charging more uniform and intelligible to the consumer.

Power factor tariffs in force in Great Britain might be divided into two main classes:—

Class 1.—A two-part tariff incorporating a monthly, quarterly, or annual charge per kVA of maximum demand, or an equivalent tariff based on kW demand adjusted to kVA in accordance with the power factor of the load.

Class 2.—A tariff incorporating a power-factor bonus and penalty clause forming an addition to any standard two-part or flat-rate tariff.

Under these two classes an extraordinary number and variety of scales of charges were instanced. The consumer was responsible for the low p.f., and it was not reasonable that the absence of a p.f. bonus or penalty clause should permit the offending consumer to penalise the whole undertaking.

Mr. Arthur Wright said that it had been found that where a bonus was given for good p.f. on maximum demand it induced users to put in correctors for the peak and to disconnect when not on maximum demand, with the result that the p.f. was generally bad and the whole undertaking suffered. In the United States they were becoming perplexed by the multitude of tiny motors in refrigerators. It was not possible to put in two meters for a load of this nature, and he wondered if a remedy was the kilovolt-ampere-hour meter. When there was a bonus for good p.f. the lighting users, whose p.f. was nearly unity, should have full consideration.

Mr. E. W. Hill said that in a sense the consumer was innocent, and it was not his fault that the supply authority gave him energy of which he did not make use. They should avoid the psychological effect of the term "penalty" and stress the inducements to good p.f.

STUDENTS' CARNIVAL.—A large number of members and friends spent an enjoyable evening at the carnival arranged by the South Midland Students' Section of the Institution, at the Imperial Hotel, Birmingham, on December 12th. The carnival publicity secretary was Mr. J. W. Bill, of the General Electric Co., Ltd., to whose efforts the success of the event was largely due.

Royal Institution.

The Juvenile Christmas Lectures of the Royal Institution will be delivered by Mr. A. Wood on "Sound Waves and Their Uses," commencing on Thursday, December 27th, and will be given at the Institution of Electrical Engineers, Victoria Embankment, W.C.2.

The "Before Easter" lectures will commence on January 15th. On Thursdays there are to be three lectures by Sir William Bragg on the "Early History of X-Rays"; on Saturday afternoons there will be four lectures by Sir Ernest Rutherford on "Molecular Motions in Rarefied Gases." The Friday evening meetings will commence on January 18th, when Sir William Bragg will deliver a discourse on "Further Progress in Crystal Analysis."

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. THOMAS SMALLEY, who for the past seven years has been manager of the Leigh Corporation Tramways, has been appointed manager of the Barrow Corporation tramways and motor-'bus undertaking, at £550 per annum.

The newspapers report that the Hon. J. L. PERRON, K.C., Quebec Provincial Minister of Roads, has been elected a director of the Shawinigan Water & Power Co. to fill the vacancy created by the death of Mr. R. W. Kelly.

The Sunderland Corporation has granted £403 (equal to six months' salary of her late husband, Mr. A. R. Dayson) to Mrs. DAYSON. A new general manager and engineer of the Corporation Tramways, at £800 per annum, is to be advertised for.

Mr. G. H. HOOKE, who has taken up an appointment as branch manager at the Nottingham offices of the Hotpoint Electric Appliance Co., Ltd., was previously with Messrs. J. and T. Kemp, Ltd., electrical wholesale merchants, in the same city.

Mr. H. FORD, electrician, Kirkwall, has been appointed manager of the Kirkwall Council's electricity undertaking, in succession to Mr. W. C. ROY, who has received an appointment in Wick.

Mr. H. HUGH JAQUES, who for the past ten years has been on the technical sales staff of Messrs. Landis & Gyr, Ltd., has resigned his position on being appointed to the staff of Messrs. Kennedy & Donkin, consulting engineers.

Mr. W. J. H. DIPLOCK, whose death was mentioned on p. 1035 of our last issue, had been a director of Erith's Engineering Co., Ltd., since 1918. Two new directors have been appointed, namely, Messrs. R. S. Erith and H. Kidson, F.C.A.

The President of the Board of Education has appointed Mr. J. T. BROWNLIE, C.B.E., Mr. A. A. H. FINDLAY, and Mr. W. SHERWOOD to be members of the Committee on Education for the Engineering Industry.

The Colchester Town Council has appointed Mr. A. F. WATSON, senior switchboard attendant at the Bradford Corporation electricity works, as shift charge engineer.

The engagement was announced last week between Mr. DENIS ZIANI DE FERRANTI, youngest son of Dr. and Mrs. de Ferranti, of Baslow Hall, Bakewell, and ELIZABETH ESPLIN, youngest daughter of Mr. and Mrs. Charles Allen Thomson, of Belville, New Jersey, U.S.A.

Mr. C. REMINGTON, who for the past 20 years has been on the engineering staff of the Automatic Telephone Co., has resigned his position and taken up a post as general manager to Messrs. Garnett, Whiteley & Co., Ltd., Liverpool, manufacturers of "Lotus" wireless products.

Obituary.—MR. C. J. H. STREET.—Mr. C. J. H. Street, engineer and clerk of works, Pritchett & Gold and E.P.S. Co., Ltd., passed away on November 24th at the age of 53 years, after eighteen months' illness. He joined the staff of the original company of Pritchett & Gold, Ltd., accumulator makers, at the old works at Feltham, Middlesex, 23 years ago, being attached for some time to the outdoor staff, later taking charge of the London offices. In 1913 Mr. Street took charge of the building and equipping of the large new works at Dagenham Dock, Essex, followed shortly after by the considerable extensions necessitated by the taking over of the Electrical Power Storage Co., Ltd., of Millwall, and Peto & Radford, Ltd., of Ashtead. Mr. Street, who had many friends in the industry, will be keenly missed. He leaves a widow and two daughters.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Wright (Electric Power Specialities), Ltd.—Private company. Registered December 13th. Capital, £6,000 in £1 shares. Objects: To acquire all or part of the assets of the business of electrical engineers and manufacturers of electrical appliances carried on at Halifax and elsewhere as Wrights Motors, Ltd., and to carry on this and the business of wire drawers, cable makers, rubber manufacturers and manufacturers of motor-cars or accessories, &c. The first directors are:—H. H. Wright, 21, Savile Place, Halifax, electrical engineer (chairman); J. P. Graham, Hill Croft, Stocksfield-on-Tyne, sales engineer. Solicitors: Hirst, Whitley & Akeroyd, 5, Harrison Road, Halifax.

Electric Supplies (Bloxwich), Ltd.—Private company. Registered December 13th. Capital, £5,000 in £1 shares. Objects: To carry on the business of manufacturers of electrical supplies, apparatus, appliances, &c. The directors are:—J. Wootton, Victoria Avenue, Bloxwich; H. Wootton, Victoria Avenue, Bloxwich; H. Garrett, Stafford Road, Bloxwich; T. Somerfield, Clarendon Street, Bloxwich; W. J. Garrett, The Post Office, Walsall Road, Great Wyrley. Secretary: H. Wootton.

Hayward & Shepherd, Ltd.—Private company. Registered December 8th. Capital, £500 in £1 shares. Objects: To carry on the business of electricians, dealers in electrical appliances and fittings, &c. The provisional directors are:—Miss M. C. Walker, 23, Kildare Gardens, W.2; Ethel M. Dol ey, 29b, Holland Park Gardens, W.14. Solicitor: Ethel M. Dolbey.

Turbine (Thomas), Ltd.—Private company. Registered December 4th. Capital, £30,000 in £1 shares. Objects: To acquire from M. Thomas, 21a, Quai du Havre, Rouen, France, the benefit of certain existing inventions relating to "rotary machines driven by currents." The subscribers (each with one share) are: G. Wybrow, 100, Denmark Road, Myatts Park, S.E.5, solicitor's clerk; A. W. Whicker, 60, Westville Road, Shepherd's Bush, W.12, solicitor's clerk. Registered office: 60, Cheapside, E.C.4.

Anglo-Oriental Concessions, Ltd.—Private company. Registered December 3rd. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers and importers and exporters of electric and incandescent lamps, gramophones and apparatus appertaining thereto, and all articles of an electrical nature, &c. The subscribers (each with one share) are: Doris Keyse, 133, Shardeloes Road, Brockley, S.E.4, clerk; Alice Blackborow, 15, Rosebank Road, Leyton, E.17, clerk. Registered office: Albion House, 59, New Oxford Street, W.C.1.

King's Inventions (Electric), Ltd.—Private company. Registered December 8th. Capital, £7,500 in £1 shares. Objects:—To adopt an agreement with W. C. King and to carry on the business of heating, electrical, mechanical, and general engineers carried on by him at Liverpool. The subscribers (each with one share) are:—J. Latin, 18, Balmoral Road, Fairfield, Liverpool, managing clerk; C. G. Bowditch, 8, Clarence Road, Wallasey, chartered secretary. Solicitor: A. M. Hannay, 41, Castle Street, Liverpool.

Shrosbery, Bakewell & Co., Ltd.—Private company. Registered December 10th. Capital, £1,000 in £1 shares. Objects:—To acquire the business now carried on in Attleborough, Norfolk, as "A. J. Shrosbery," and to carry on the business of electrical engineers and contractors, &c. The directors are:—A. J. Shrosbery, Queen's Road, Attleborough, Norfolk; F. J. Bakewell, Wrest, Pembury, Kent. Registered office: 69, Crouch Street, Colchester, Essex.

Pye (Radio), Ltd.—Private company. Registered December 7th. Capital, £100 in £1 shares. Objects:—To carry on the business of manufacturers of, and dealers in radio sets and apparatus, and mechanical and electrical appliances, &c. The subscribers (each with one share) are:—W. J. Lovell and C. P. Staples, 199, Piccadilly, W.1, clerks. Solicitors: Bartlett and Gluckstein, 199, Piccadilly, W.1.

Marweb Co., Ltd.—Private company. Registered November 27th. Capital, £2,000 in £1 shares. Objects:—To adopt an agreement with H. C. Gamble, to carry on the business of electric sign manufacturers and publicity contractors and agents formerly carried on by him as "Marweb Co.," at 36, Causeway Lane, Leicester, and to acquire the trade mark "Marweb" and device. The directors are:—H. C. Gamble, "Rostrevor," Letchworth Road, Leicester, electrical engineer; and M. Webster, 22, Chaucer Street, Leicester, electrical engineer. Registered office: 38, Causeway Lane, Leicester.

Full Light Anti-Dazzle Lamp (Parent), Ltd.—Registered as a public company December 8th. Capital, £80,000 in 1s. shares. Objects:—To adopt an agreement with the Full Light Anti-Dazzle Lamp Co., Ltd., and to carry on the business of manufacturers of, and dealers in anti-dazzle lamps and devices, and electric lamps, mechanical, electrical, and motor engineers, &c. The subscribers (each with one share) are:—A. S. Weeding, 11b, St. James' Square, Holland Park, W.11, clerk; J. R. H. H. Orbell, 70, Watcombe Road, South Norwood, S.E.25, clerk; and five others. Solicitors: Arthur Veasey and Co., Aldwych House, W.C.2.

Vernon Wise (Shepherd's Bush), Ltd.—Private company. Registered December 10th. Capital, £100 in £1 shares. Objects:—To carry on the business of authorised "Exide" battery service station agents, automobile, electrical, wireless, and television engineers, electrical contractors, &c. The first directors are:—V. Wise, 298, Sandycombe Road, Kew, electrical engineer; L. I. Simpson, 36a, Penywern Road, Earl's Court, S.W.1, C.A. Registered office: 298, Sandycombe Road, Kew.

Official Returns of Electrical Companies.

Coniston and District Electric Supply Co., Ltd.—Capital, £3,500 in 2,500 6 per cent. preference and 1,000 ordinary shares of £1 each. Return dated October 13th, 1928. 2,253 preference and 500 ordinary shares taken up. £2,473 paid. £280 considered as paid. Mortgages and charges nil.

Electricity Distribution of North Wales and District, Ltd.—Capital, £205,500 in 200,000 preference shares of £1 each and 110,000 ordinary shares of 1s. each. Return dated May 16th (filed August 21st), 1928. 150,000 preference and 110,000 ordinary shares taken up. £152,000 paid on 150,000 preference and 40,000 ordinary shares. £3,500 considered as paid on 70,000 ordinary shares. Mortgages and charges £150,000.

Carter & Co. (Nelson), Ltd.—Capital, £5,000 in £1 shares. Return dated June 2nd, 1928. 4,150 shares taken up. £4,150 paid. Mortgages and charges £537.

Julius Sax & Co., Ltd.—Capital, £10,000 in 3,000 7½ per cent. preference and 35,000 ordinary shares of £1 each. Return dated November 12th, 1928. 2,650 preference and 18,000 ordinary shares taken up. £5,051 paid on 2,650 preference and 12,005 ordinary shares. £1,199 considered as paid on 5,995 ordinary shares. Mortgages and charges nil.

Stuart Electrical Co., Ltd.—Capital, £4,000 in £1 shares. Return dated October 9th, 1928. 1,865 shares taken up. £502 paid. 1,363 considered as paid. Mortgages and charges nil.

Omega Lampworks, Ltd.—Issue on September 7th, 1928, of £2,000 debentures, part of a series already registered.

Halcyon Wireless Co., Ltd.—Debenture dated November 26th, 1928, to secure £10,000, charged on the company's property, present and future, including uncalled capital. Holders: Westminster Bank, Ltd.

J. G. White & Co., Ltd.—Capital, £350,000 in 360,000 ordinary shares of 4s. each and 278,000 ordinary shares of £1 each. Return dated July 5th, 1928. 360,000 4s. ordinary shares taken up. £66,000 paid. £6,000 considered as paid. Mortgages and charges, nil.

Weston-super-Mare and District Electric Supply Co., Ltd.—Capital, £100,000 in 40,000 preference and 60,000 ordinary shares of £1 each. Return dated May 3rd (filed July 11th), 1928. All shares taken up. £100,000 paid. Mortgages and charges, £37,500.

A. W. Penrose & Co., Ltd.—Capital, £45,000 in 30,000 ordinary, 10,000 first preference, and 5,000 second preference shares of £1 each. Return dated June 14th (filed August 11th), 1928. 30,000 ordinary, 10,000 first preference and 500 second preference shares taken up. £10,507 paid. £29,993 considered as paid. Mortgages and charges, £1,300.

Brundall & District Service Co., Ltd.—Capital, £10,000 in £1 shares. Return dated May 26th, 1928. 5,175 shares taken up. £4,925 paid. £250 considered as paid. Mortgages and charges, £5,500.

Baynes Electrical Co., Ltd.—Capital, £2,000 in £1 shares. Return dated October 15th, 1928. 214 shares taken up. £214 paid. Mortgages and charges, nil.

Maldon Electric Works, Ltd.—Capital, £10,000 in 8,000 5 per cent. cumulative preference and 2,000 ordinary shares of £1 each. Return dated May 29th, 1928. 4,902 preference and 2,000 ordinary shares taken up. £4,902 paid on 4,902 preference shares, £2,000 considered as paid on 2,000 ordinary shares. Mortgages and charges, nil. Returns of allotments, made up to November 17th, 1928, show a further 2,230 preference shares allotted, payable in cash, and fully called up.

Exe Valley Electricity Co., Ltd.—Capital, £6,000 in 4,000 preference and 2,000 ordinary shares of £1 each. Return dated June 14th, 1928. 3,600 preference and 2,000 ordinary shares taken up. £5,300 paid on 3,600 preference and 1,700 ordinary shares, £300 considered as paid on 300 ordinary shares. Mortgages and charges: £980.

Synchronome Co., Ltd.—Capital, £2,000 in 600 preference and 1,400 ordinary shares of £1 each. Return dated November 7th, 1927 (filed June 13th, 1928). All shares taken up. £799 paid, £1,300 considered as paid. Mortgages and charges, nil.

Vincent Switchgear Manufacturing Co., Ltd.—Capital, £10,000 in £1 shares. Return dated October 8th, 1928. 7,948 shares taken up. £7,948 considered as paid. Mortgages and charges, nil.

Eagle Valves, Ltd.—Debenture dated November 28th, to secure £2,000 charged on the company's property, present and future, including uncalled capital. Holder: Lotte Sachnovies, 1, Compayne Gardens, Hampstead, N.W.

City Notes.

Venezuela Telephone and Electrical Appliances Co., Ltd.

Mr. J. S. Austen (chairman) presided at the annual meeting on December 12th, and in presenting the report and accounts (Elec. Rev., December 7th, p. 993) referred to the proposed sale of the United River Plate Telephone Co. as an indication of the potential value of sound telephone companies. Their company had made normal progress, and the increased net profit had enabled them to pay the extra dividend required by the increase of capital, and add about £1,800 to their excess profits account. Their automatic exchange in Caracas was practically completed, and the subscribers would be changed over gradually to the new system. To provide for the scrapping of the old plant they had a depreciation reserve of £93,000. They would then build up the fund again against future developments. The conversion had cost a large sum of money, and it would be necessary to raise further funds. He could not say at the moment whether this would be done by an issue of shares or by some other method. In conclusion, Mr. Austen announced his intention of retiring from the position of chairman, and said that he hoped Sir Alexander Roger would be his successor.

Marconi International Marine Communication Co., Ltd.

The scheme providing for the retention of the control of this company in British hands (*vide* our last issue, p. 1036) was approved at a meeting on December 14th. Senatore Marconi (chairman) presided, and moved the resolution, which was seconded by Mr. F. G. Kellaway (managing director). The latter recalled that a similar step had been taken in 1926 by Marconi's Wireless Telegraph Co., Ltd., at the instance of the Government, but said that no pressure from the Government had been necessary to convince the directors that the arrangement was very desirable in the case of the Communication Company. The proposal had received general approval; no indication of opposition had been given by any shareholder. He did not hold the view that a similar provision ought necessarily to apply to other industrial concerns in the British Empire; their company was concerned with vital national interests. The American Marconi Company had become purely American in character, showing that a similar view was held there. The board was satisfied that the recent activity in the company's shares had an American origin; the shrewd financial advisers of the United States were fully aware of the company's strong position.

Bogota Telephone Co., Ltd.

The report for the year ended June 30th last shows a gross revenue of £45,944 and a profit of £20,777 (against £23,888 in 1926-27). A balance of £9,202 brought forward is added, making £29,979. From this £5,000 is put to depreciation; a final dividend of 5 per cent. is to be paid on the old ordinary share capital, making 10 per cent. for the year, against 12½ per cent.; and interest at 6 per cent. per annum is to be paid on the new capital; this leaves £6,602 to be carried forward. The results of the year's working were adversely affected by a strike and by increases in wages. The extensions are being carried out as rapidly as possible; there has been delay in the transport of the materials. Meeting: December 31st.

Bullers, Ltd.

The profit for the year ended July 31st last was £24,479, as compared with £15,614 in 1926-27. The increase is attributed to improved production methods and the reduction of establishment charges. The national electrification scheme has increased the home demand for the company's products, but it has also attracted Continental interests which are building a new factory in this country for the manufacture of porcelain. Therefore, after meeting debenture redemption and the preference dividend, the directors propose to place £10,000 to reserve and to carry forward £2,724.

S. Smith & Sons (Motor Accessories), Ltd.

The net profit for the past year was £110,521 (against £101,432). The dividend on the ordinary shares is increased from 14 to 17½ per cent., and that on the deferred ordinary shares from 25 to 37½ per cent. £10,000 is written off patents, £25,000 transferred to general reserve, and £43,079 carried forward. The directors propose to increase the capital by the creation of 50,000 preferred ordinary shares of £1 each and 280,000 deferred ordinary shares of 1s. each. These will be offered to present shareholders. The preferred ordinary shareholders will have the right to subscribe for one new preferred share at 30s. for each three shares held; one deferred share at 3s. will be offered to holders of the existing deferred shares for each three held by them.

Mann, Egerton & Co., Ltd.

The report for the year ended September 30th shows a profit of £30,674, as compared with £34,510 for 1927. The directors propose to pay 8 per cent. on the preference shares (absorbing £16,833), to pay a dividend of 9d. per share on the ordinary shares (£2,423), to pay 5 per cent. on the funding certificates (£932), to allocate £8,000 to the redemption of funding certificates, and to carry forward a balance of £12,312, subject to income tax on the amount of certificates redeemed. Meeting: To-day (Friday).

Prospectus.

Universal Refrigerators, Ltd.—Last week this company published a prospectus offering for subscription 800,000 shares of 2s. 6d. each at par, out of a total capital of £125,000. The company has been formed particularly to deal with "Amundsen" refrigerators, which can be operated by electricity, gas, or petrol. These refrigerators are to be manufactured for the company by Messrs. Haslam & Newton, Ltd., Derby. The company expects to sell 100 machines of the domestic type per week, the price being lower than that of existing makes.

Wireless Pictures (1928), Ltd.

At the statutory meeting of this company, which deals with the "Fultograph" system, on December 14th, a statement was presented showing that 775,000 ordinary shares of 4s. each had been allotted for cash and 400,000 in consideration of the terms of four contracts, in addition to £45,000 in cash. Preliminary expenses amounted to £24,640, stamp duty on contracts to £1,257, and underwriting commission, &c., to £8,885. Cash at bank and in hand was shown at £60,638.

Chili Telephone Co., Ltd.

The accounts for the year ended March 31st last record a gross revenue of £230,278, and a net profit of £47,300, as compared with £80,586 in 1926-27. The addition of £10,024

brought forward makes available £57,324. The final ordinary dividend is 3s. per share, free of tax, maintaining the total distribution at 6 per cent. A balance of £3,324 is carried forward. The annual meeting was held on December 14th.

Stock Exchange Notices.

Dealings in the following have been specially allowed by the Committee of the Stock Exchange under Rule 159:—

Low Temperature Carbonisation, Ltd.—46,855 ordinary shares of 2s. each, fully paid, Nos. 7,320,634 to 7,367,488.

Midland Counties Electric Supply Co., Ltd.—12,000 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1,680,001 to 1,692,000.

Radiovisor Foreign and Colonial, Ltd.—380,000 shares of £1 each, fully paid, Nos. 1 to 380,000.

Lancashire Electric Power Co.

A meeting of shareholders was to be held yesterday (Thursday) to consider a resolution providing for the increasing of the authorised share capital from £3,000,000 to £4,000,000 and the loan capital from £1,000,000 to £2,000,000.

Associated Telephone and Telegraph Co.

The following quarterly dividends are announced: First preferred stock, $1.75; Classes "A" and "D" stock $1.00; and Class "C" stock $0.75.

Anglo-Argentine Tramways Co., Ltd.

The dividends in respect of the half-year ending December 31st have been declared on the 5½ per cent. first and 6 per cent. second preference shares.

Eastern Extension, Australasia and China Telegraph Co., Ltd.

The directors have declared the usual quarterly dividend of 5s. per share, free of tax, in respect of the three months ended September 30th last.

Eastern Telegraph Co., Ltd.

An ordinary dividend of 2½ per cent., free of tax, has been declared in respect of the quarter ended September 30th.

Lisbon Electric Tramways, Ltd.

An interim dividend of 3 per cent. net has been declared on the ordinary shares, as last year.

Shawinigan Water and Power Co.

A dividend of $0.5 per share has been declared on the common shares for the quarter ending December 31st.

Yorkshire (West Riding) Electric Tramways, Ltd.

The final (half-yearly) dividend has been declared on the 6 per cent. cumulative preference shares.

Great Northern Telegraph Co. of Denmark, Ltd.

A dividend of 2½ per cent. is announced, payable January 1st.

Greenwood & Batley, Ltd.

An interim dividend of 2½ per cent. has been declared, as in 1927.

W. & T. Avery, Ltd.

The ordinary shares are again to receive an interim dividend of 5 per cent.

French Companies.

The *Société Electro-Câble*, after writing off 7,045,000 fr., reports net profits of 8,740,000 fr. for 1927-28, against 7,515,000 fr. in the previous year. The dividend on the ordinary shares is maintained at 50 fr. per share.

The *Société des Exploitations Electriques* reports net profits of 3,955,000 fr. for 1927-28, as compared with 2,018,000 fr. in the previous year. It is proposed to increase the dividend from 18.75 fr. to 20 fr. per share.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange markets have now entered upon the first settlement in the New Year, dealings at the present time being in respect of the account which finishes on January 10th, 1929. There is abundance of money available for investment, notwithstanding the claims which are seasonal to the end of the year, and, although gilt-edged securities are affected to some extent by the anxiety regarding the health of the King, quotations are maintained, in most cases with noticeable firmness. Evidence of this can be found in the lists of shares of electricity supply companies, as well as in the continued difficulty that exists in obtaining reasonable supplies of good-class stock. The excitement in Marconis has diminished to some extent: cable stocks and shares are steady. The manufacturing group is disposed to remain dullish for the same reasons as those mentioned here a fortnight ago. Brazilian Tractions enjoyed a dramatic rise.

Stocks and Shares on Offer.

Amongst the bonds and debentures that are obtainable at present may be mentioned Atlas Light and Power 6 per cent. debenture at 106, which pays £5 13s. 3d. per cent., and is reasonably well-secured. The stock is redeemable by drawings at, or purchase up to, 105; also at any time at that price. Belgian Electric 5½ per cent. sterling bonds, which are well protected by security, can be bought at 97, also to give £5 13s. 3d. on the money. British Thomson-Houston 7 per cent. mortgage debenture stock at 105½ yields £6 12s. 6d., but, as we have pointed out on previous occasions, there is the risk of the stock being drawn at 100. A small amount of Newcastle-on-Tyne 4½ per cent. first mortgage debenture stock is offered at 95½, the return in this case being £4 14s. 3d. per cent., with January and July interest payments. The cover here is something like eight times the amount required for the service of the interest, and the return is raised to £5 1s. per cent. on the money when redemption is taken into account at 100 in 1939. The company has the right to repay this stock earlier at 105. Perak River Hydro-Electric 7 per cent. participating debenture stock at 118½ gives £5 18s. per cent. on the money, and the company's prospects may be said to justify the quotation. Although the hydro-electric station has been somewhat delayed, the steam station started work last week, almost a year ahead of the programme time.

Debenture and Preference.

About £1,000 Shropshire, Worcestershire and Staffordshire 5½ per cent. first debenture stock can be bought at 106, with February and August interest payments, the return here being £5 3s. 9d. per cent., and the interest thoroughly well margined. Carrying a certain tint of speculation is the Tokio Electric 6 per cent. first mortgage bond. The price is 96½, and this affords 6¼ per cent. on the money, a small interest payment—namely, 45s. per cent.—having been just met. In the list of preference shares there is more variety, of course, and higher rates of return are to be obtained. Amongst the shares which can be bought free of stamp duty are Midland Counties Electric 6 per cent. cumulative preference at 22s. 9d., paying 5¼ per cent., and Mersey Power 6 per cent. cumulative preference at 22s. 3d., which yield £5 8s. per cent.

United River Plate Telephone Plum.

United River Plate Telephone shares have enjoyed an almost sensational rise in consequence of a bid which has been received on behalf of a syndicate. The offer gives holders of the United River Plate Telephone ordinary shares the option of exchanging five ordinary for £22 10s. in cash, plus one $100 share in the capital stock of the International Telephone and Telegraph Corporation. Alternatively to this, the holder can take £12 in cash for each of his ordinary shares. The offer is conditional upon its acceptance by 75 per cent. of the voting power not later than January 3rd next.

On the basis of the present price of International Telephone and Telegraph, the proposal works out to something like £12 6s. for every ordinary United River Plate Telephone share, and the cash offer of £12 was more than 20s. higher than the price current for the shares on the day before the offer was made. The immediate effect was to put up the price, of course, to the neighbourhood of the cash offer; and, seeing that only a month ago the shares were languishing in the neighbourhood of £9, it is obvious that the United River Plate Telephone shareholders have done very well. Many of them have already signified their intention of accepting the terms.

It is natural that this should have led to a looking round the market to see what other company may be likely to strike the fancy of the omnivorous International Telephone and Telegraph Company, but although several are mentioned in this connection, none of the prices has yet responded to the vague expectations that have been raised. Venezuelas have come into request at 26s. and rather more. Oriental Telephones at 3¾ have gained a small fraction. Bogota Telephones have been somewhat neglected of late; the old ordinary were last sold at 26s. 3d. at the new of November, and the new shares at 25s. 6d., about the same time. The company has declared a dividend of 10 per cent. per annum on the old capital, and interest at the rate of 6 per cent. per annum on the new shares. Last year's dividend on the then smaller capital was 12½ per cent.

The Wireless Group.

The Parliamentary discussions in connection with the cable-wireless merger have ceased to arouse more than an academic interest, it being taken for granted that the scheme will go through on oiled wheels, and that, early in the New Year, steps will be taken for the distribution of the new securities to the cable and the Marconi companies. Prices of the cable issues are a little better, despite the money requirements that mark the end of the year. Some of the most important holders of the stocks have been increasing their interest, and pro-

prietors will probably do better by retaining their stock than by selling it at the current figures. The price of Marconi shares is 1/16 up, the principal change this week occurring in Marconi Marines, where, after being 3¼, the price jumped to 3⅜ on renewal of buying orders from America. Marconi preference shares are 4⅜. Canadian Marconi dipped to 30s. before recovering to 1⅛. Burndepts have gone back to 6s. 6d. The market in the shares of most of the newly-issued recording companies has been somewhat heavy. Wild movements continue to occur in Radio Corporation shares in the New York Stock Exchange, where changes that range from 20 to 70 points—dollars—per diem, have not been uncommon. The "A" shares are dealt in as sterling in London, and the price is about 68; the "A" preferred stock stands at 11¼. There is talk of a possible arrangement between the Radio Corporation, the Victor Talking Machine and the Western Union.

Cable Stocks and Shares.

Great Northern Telegraphs are 25s. better, at 29½, and this is the chief change in their section. The Great Northern Telegraph Co.'s Holding Co.'s shares changed hands last week at 8⅛. The Eastern and the Eastern Extension Companies have declared their usual quarterly dividends of 2½ per cent. and 5s. per share, tax-free, respectively. Anglo-American Telegraph deferred rose ½ to 25½: the stock, it may be recalled, receives its full year's dividend of 30s. per cent. in January or February. Postal Telegraph and Cable Company 6 per cent. collateral trust debenture stock has been done at 90 within the past few days.

Automatics.

A decline to 41s. 3d. in Automatic Telephones made International Automatics a trifle easier at 36s. Shareholders in both companies are beginning to ask when they may expect increases upon the 10 per cent. dividends at present being paid. The companies occupy a satisfactory financial position, but the yields on the shares, at current prices, are very modest and the quotations may be held already to discount an advance in the dividends.

Electricity Supply.

The County of London Electric Supply Company has attracted fresh public attention by announcing a uniform tariff rate of a penny per unit, plus a fixed quarterly charge. The shares are 6d. easier on the week, though this has nothing to do with the proposed optional rate-re-arrangement. Electric Supply ordinary have fallen back to 2½; Urban ordinary and Scottish Power are both a few pence lower. Yorkshires, on the other hand, have hardened, and Newcastle-on-Tyne ordinary, with a rise of 9d. to 25s. 9d., have started to recover from the dullness that recently overtook the shares. The B.E.A.M.A. has turned its artillery upon the methods of the Bank of England, and provincial electric power shares are getting over the depression produced by the pessimisms published recently by the Association in regard to electrical progress in England. The new Shropshire ordinary and the new Northamptons are 9s. premium over their issue prices of 21s. and 30s., respectively. Newcastle new shares are 2s. premium.

Miscellaneous Matters.

Metropolitan Consolidated stock is 1½ lower at 63 upon notification that the company seeks Parliamentary powers to spend a lot more money upon development plans. The Stock Exchange continues to look, and justifiably, for an increase next month in the dividend for the year now ending. Underground Electrics are dull, the income bonds shedding 2 points.

Manufacturing shares are but little altered on the week. General Electric ordinary maintain their substantial gain at 43s. 9d., and, at the same price, British Aluminium keep firm. Crompton Parkinson ordinary reacted to 20s. A drop of 2s. 6d. lowered Johnson & Phillips to 36s. 3d.; shares changed hands down to 34s. 4½d. Metropolitan-Vickers ordinary have moved up to 30s. Telephone Manufacturing attracted business in the neighbourhood of 5s. Ever-Ready shares are 26s.: the participating preference 31s. Ever-Ready Trust & Finance, 5s. paid, after touching 1s. 3d. premium, came back to their "par" price. Active business in Everlite shares, at 7s. and thereabouts, followed demonstrations given at Winchester House.

Brazilian Tractions went back to 68½ before rising abruptly to 78¼—abruptly because the price gained 8 points in an hour. Mexican utilities are heavy. Anglo-Argentine Trams are unaffected by declaration of the preference dividends. Hydro-Electrics at 33½, International Holdings at 11⅞, and British Columbia Power "A" and "B," at 55½ and 37½, are bumpish. The home iron and steel industry continues to seek for greater prosperity through the process of linking-up, and amalgamation. This has no particular effect at present upon the market in the shares of the companies concerned. The rubber department is extremely quiet, and it is thought that the weekly arrivals will now begin to reflect the result of the withdrawal, on November 1st last, of the restriction upon output.

Share List of Electrical Companies.

	Nom.	Dividend. 1926.	Dividend. 1927.	Price Dec. 17, 1928.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	£1	14†	15	3⅞	—	... ...
Brompton Ordinary	£1	8⅜	8½	27/-	—	5 18 8
Charing Cross Ordinary	£1	8½	8½	26/6	—	5 5 6
do. do. 4½% Pref.	£1	4½	4½	17/6	—	5 3 10
Chelsea	£1	8⅝	8⅝	27/-	—	5 3 6
City of London	£1	10	10	30/9	—	4 16 0
do. do. 6% Pref.	£1	6	6	23/-	—	5 4 4
Clyde Valley	£1	8	8	39/6	—	4 1 0
County of London	£1	7½	7½	43/0	—6d.	3 9 0
do. do. 6% Pref.	£1	6	6	23/6	—	5 2 1
Edmundsons' 7% Pref.	£1	7	7	25/6	—	5 9 10
Elec. Supply Corporation	£1	11	11	2½	—2/3	4 8 0
Kensington Ordinary	£1	8	8	26/6	—	5 5 8
Lancs. Light and Power	£1	7½	7½	30/-	—	5 0 0
London Electric	£1	8½	8½	26/6	—	5 5 8
Metropolitan	£1	8	9	45/-	—	4 0 0
do 4½% Pref.	£1	4½	4½	17/6	—	5 2 10
Midland Counties	£1	6	6½	30/6	—	4 5 3
Mid. Elec. Power	£1	—	15	2	—	... ...
Newcastle-on-Tyne Ordinary	£1	5	5	25/9	+9d.	4 13 2
do. 7% Pref.	£1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref.	£10	6	6	10½	—	5 11 7
North Met. Elec. 6% Pref.	£1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	£5	8	8	27/6	—	5 1 10
Scottish Power	£1	8	8	31/6	—6d.	5 1 7
South London	£1	8½	8½	27/6	—	5 2 8
Urban Ordinary	£1	7	7	36/9	—6d.	... ...
Westminster Ordinary	£1	8½	8½	27/-	—	5 8 8
Whitehall Elec. Invst. 7½% Pref.	£1	7½	7½	23/6	—	6 7 8
Yorkshire Elec.	£1	8	8	34/6	+6d.	4 13 9
HOME RAILS.						
Central London Ord. Assented	Stock	4	4	78	—	5 9 1
Metropolitan	,,	8	8	63	—1½	4 15 3
do. District	,,	3½	4	80½	—	4 19 5
Underground Electric	£1	1½	5	26/6	—6d.	3 15 7
do. do. Income	Bonds	6	6	125	—2	4 16 0
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	102½	—	5 17 1
do. Def.	,,	1½	1½	25⅝	+⅛	5 19 6
Automatic Telephone	£1	10	10	2 1/16	—1/16	4 16 10
Eastern Extension	£10	10	10	26⅛	+⅛	*3 16 8
Eastern Tel. Ord.	Stock	10	10	262	—	*3 16 4
Globe Tel. and T. Ord.	£10	10	10	25⅝	—	*3 18 1
do. do. Pref.	£10	6	6	11⅛	—	5 8 1
Great Northern Tel.	£10	20	20	29½	+1½	... ...
Indo-European	£5	10	10	47½	—	*5 5 3
Marconi	10/-	5	*10	3 1/16	+1/16	... ...
Marconi-Marine	£1	8½	12½	3⅜	+7/6	3 9 1
Oriental Telephone Ord.	£1	12	12	3⅛	+1/8	*3 13 0
United R. Plate Tel.	£5	8	8	11½	—	*3 8 1
Western Telegraph	£10	10	10	26	—	3 17 0
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref.	£5	5½	5½	8½	—	7 9 1
do. do. 2nd. Pref.	£5	6	6	8⅝	—	5 11 6
do. do. 5% Deb.	Stock	5	5	77	—	6 9 10
British Electric Traction Def. Ord.	,,	—	—	595	—	... ...
do. do. Pref. Ord.	,,	8	7½	124	—	5 19 6
Brazil Traction	£100	6	7	78¼	+8⅛	2 4 7
Brit. Colombia Elec. Rly. Pcs.	Stock	5	5	90½	—	5 2 7
London & Sub. Trac. 5% Pref.	£1	Nil	Nil	12/-	—	... ...
London United Tram Deb.	Stock	4	4	62	—	6 9 1
Mexico Trams, 5% Bonds	—	5	5	80	—	6 5 0
Mexican Light Common	£100	Nil	Nil	77½	—⅛	... ...
do. 7% Pref.	£100	Nil	7	76½	—2	9 3 0
do. 1st Bonds	—	5	5	77	—	6 10 0
Yorkshire (West Riding)	£1	Nil	Nil	5/-	—	... ...
MANUFACTURING COMPANIES.						
Babcock & Wilcox	£1	13	15	67/-	—	*4 9 0
British Aluminium Ord.	£1	10	10	43/9	—	*4 11 4
British Elec. Transformer Pref.	£1	7	7	18/-	—	7 15 0
British Insulated Ord.	£1	15	15	4	—	3 15 0
Brush Ord.	£1	10	10	28/9	—	6 19 5
Callenders	£1	15	15	4	—	3 15 0
do 6½% Pref.	£1	6½	6½	1½	—	5 4 0
Crompton Parkinson Ord.	5/-	—	—	20/-	—6d.	... ...
do. 8% Pref.	£1	—	8	25/-	—	6 8 0
Edison-Swan	£1	10	10	19/6	—	3 4 0
do. 5% Deb.	Stock	5	5	89½	—	5 11 9
Electric Construction	£1	7½	7½	26/9	—	5 12 1
Enfield Cable Ord.	£1	20	20	4 7/8	—	4 6 7
English Electric	£1	Nil	Nil	7/6	—	... ...
do. do. Pref	£1	8	Nil	10/-	—	... ...
Gen. Elec. Pref.	£1	6½	6½	23/6xd.	—	5 10 8
do. Ord.	£1	7½	10	43.9	—	4 11 4
Henley	£1	25	25	58	—	4 9 0
do. 4½% Pref.	£5	4½	4½	4½	—	5 6 0
India-Rubber	£1	Nil	Nil	11/3	—	... ...
Johnson & Phillips	£1	12½	10	36/3	—½	5 10 3
Met.-Vickers Ord.	£1	8	6	30/-	+1/8	... ...
do. Pref.	£1	8	8	22	—	5 16 8
Siemens Ord.	£1	7½	7½	26/3	—	5 14 5
Telegraph Construction	£12	10	10	25	—	*4 16 0

†4% of which was tax free.

*Interim.

*Dividends paid free of Income Tax.

Our Foreign Electrical Trade.

Electrical Exports and Imports during November, 1928.

ALTHOUGH the Board of Trade returns of overseas trade for November showed a rise of £104,475 in electrical exports as compared with the preceding month, the shipments fell short by £121,381 of those of November, 1927, and to this extent the decline from the 1927 total was increased. In part extenuation of these circumstances it may be said that the exports during November, 1927, were the highest (with one exception) for the past five years, due to a great extent to a large shipment of submarine cable. In comparing the month's figures with those for October, some rather wide fluctuations are noted. While there were substantial advances in "other" motors and generators, insulated wires and cables, and unenumerated machinery, there were also falls of some magnitude in telegraph and telephone apparatus, batteries and accumulators, and submarine cable. Decreases predominate in the comparison with November, 1927, those in the telegraph and telephone section accounting mainly for the fall in the total. We are accustomed to noting enormous variations in the submarine cable exports, but this time instruments and apparatus show the largest decline (£93,996). This item, too, is subject to severe fluctuations; this year it has been as low as £128,481 (September) and as high as £332,270 (March).

We pointed out when dealing with the October trade that the month's imports had reached a record figure; last month they went still higher. The increase was due to four items, the principal of which were unenumerated goods and apparatus, and telegraph and telephone apparatus; the remainder of the items showed decreases—fairly large ones in the case of unenumerated machinery and insulated wires and cables. As compared with November, 1927, the imports increased by £56,803, several items rising to a substantial extent. The leading increase, that of telegraph and telephone instruments, may be contrasted with the large decrease in exports of that class. For the completed part of the year the imports stand £555,553 above those of the corresponding period of 1927, which is well above the monthly average for the latter year (£487,788).

Small consolation may perhaps be derived from the rises in the exports of imported articles, but they do not affect the general position very much.

The following table indicates the distribution of November electrical machinery exports, and compares the figures with those for the corresponding month of 1927:—

Destination.	Nov., 1927.	Nov., 1928.	Inc. or dec.
	£	£	£
Europe	78,401	87,932	+ 9,531
Japan	42,751	6,040	− 36,711
South America	73,512	46,497	− 27,015
South Africa	73,846	42,058	− 31,788
British India	95,421	186,255	+ 90,834
Australia	99,947	92,731	− 7,216
New Zealand	38,543	41,087	+ 2,544
Canada	29,441	49,569	+ 20,128
Other countries	86,515	100,071	+ 13,556
Totals	£618,377	£652,240	+ £33,863

Although there were three large increases, the rise in shipments to European countries is probably the most interesting feature of the table. The figures for the eleven months ended with November shows that Europe has risen from fourth to second place in the list of our electrical machinery markets, the actual value of the goods taken having increased from £873,789 to £1,012,997. India has risen from second to first place, her share having advanced from £1,047,685 to £1,394,079. Australia has fallen to the second place, her proportion having declined from £1,190,521 to £917,591. The most serious decline has occurred in the case of South Africa; the value of goods shipped to the Union has fallen from £984,354 to £411,541. The total value of electrical machinery exports for the eleven months is £6,191,710, as compared with £6,222,569 in the corresponding period of 1927. The exports of electrical goods and apparatus attained a value of £10,706,475 against £10,897,323.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Nov., 1928.	Inc. or dec. as compared with Oct., 1928.	Inc. or dec. as compared with Nov., 1927.	Electrical imports for Nov., 1928.	Inc. or dec. as compared with Oct., 1928.	Inc. or dec. as compared with Nov., 1927.	Electrical re-exports for Nov., 1928.	Inc. or dec. as compared with Oct., 1928.	Inc. or dec. as compared with Nov., 1927.
Electrical goods and apparatus (unenumerated)	£247,216	+ £19,154	+ £24,495	£167,648	+ £25,970	+ £15,938	£8,659	+ £252	+ £2,530
Insulated wires and cables ...	292,751	+ 57,699	+ 18,073	79,229	− 14,364	+ 20,326	838	− 141	− 96
Glow lamps	50,392	− 7,683	− 2,596	23,460	− 2,321	− 29,723	785	+ 91	− 95
Arc lamps and parts ...	2,607	+ 1,677	+ 2,004	2,834	− 1,812	− 270	59	+ 54	− 92
Batteries and accumulators ...	83,167	− 24,111	− 4,973	111,358	− 3,499	+ 20,702	1,256	+ 591	+ 758
Meters and instruments ...	37,338	+ 1,067	− 3,957	22,144	− 5,551	− 6,068	338	− 794	− 116
Carbons	545	− 7	− 3,028	15,641	+ 5,796	+ 6,710	69	− 47	+ 53
Switchboards (not telegraph or telephone)	4,936	+ 1,119	− 3,091	651	+ 506	+ 629	211	+ 211	+ 211
Electrical Machinery—									
Electrical machinery (unenumerated)	363,424	+ 35,197	− 1,957	135,988	− 17,336	+ 8,343	18,318	+ 9,731	+ 4,156
Railway and tramway motors	36,252	− 8,424	− 1,700	—	—	—	—	—	—
Other motors and generators ..	252,564	+ 63,733	+ 37,520	—	—	—	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	77,608	+ 20,453	− 29,622	1,782	− 2,397	− 16,010	10	+ 10	+ 10
Submarine telegraph and telephone cable	13,134	− 22,691	− 58,553	—	—	− 56	—	—	—
Telegraph and telephone instruments and apparatus ...	187,663	− 32,708	− 93,996	99,048	+ 22,993	+ 36,282	6,883	+ 6,071	+ 2,011
Totals	£1,649,597	+ £104,475	− £121,381	£659,783	+ £8,985	+ £56,803	£37,426	+ £16,029	+ £9,330
		Exports.			Imports.			Re-Exports.	
Increases and decrease for eleven months of 1928		− £221,707			+ £555,553			+ £53,386	

Submarine Telegraph Cables.

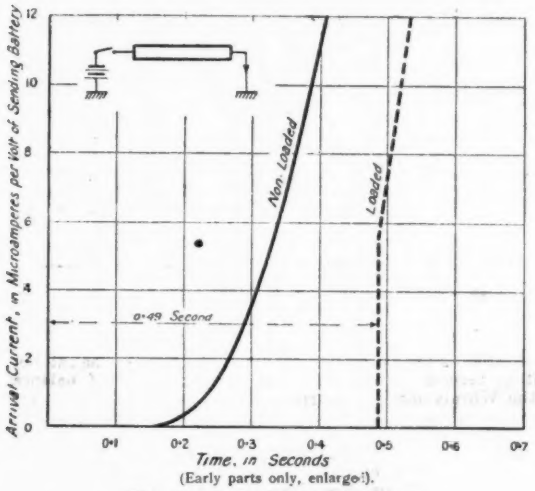
Some Aspects of the Present State of the Art of Continuously Loading Transoceanic Cables.*

By A. E. FOSTER, P. G. LEDGER, M.I.E.E., and A. ROSEN, Ph.D., A.M.I.E.E.

(*Extracts from Paper read before the* Institution of Electrical Engineers.)

More than 90 per cent. of the world's submarine cables, the length of which is over 300,000 miles, has been constructed within a few miles of this Institution, and this vast network of communication cables represents a capital expenditure exceeding 50 million pounds.

The current at the receiving end of a cable grows very slowly, compared with that at the sending end; hence if a succession of positive and negative impulses are applied too rapidly they tend to annul each other, or overlap, before sufficient time has elapsed to build up definite positive and negative charges, with the result that the recorded signals



(Early parts only, enlarged).

Fig. 1.—Arrival Current Curves.

at the receiving end become undecipherable. An average of 3.75 impulses, or contacts, is necessary per letter of the Morse code, allowing for spacing between letters and between words; a transmitting speed of s letters per minute, therefore, represents s/16 impulses per second.

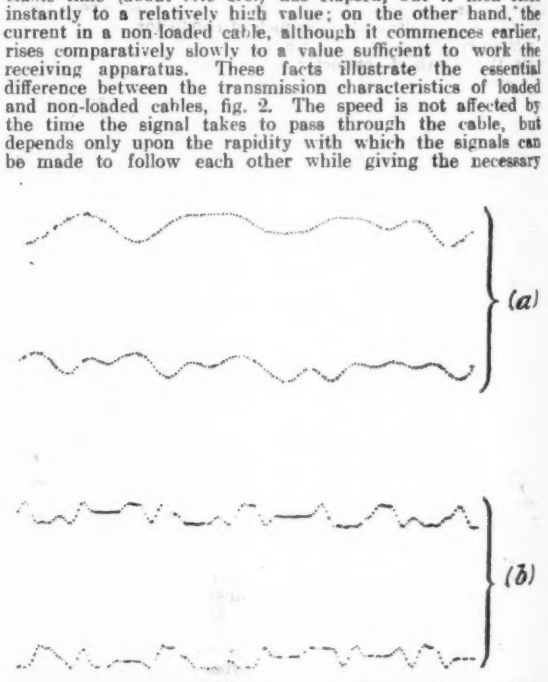
Attenuation and distortion of the current impulses, which limit the speed of signalling, are mainly attributable to the resistance and capacity of the cable, but another significant factor in the deformation of the signal is extraneous interference arising from earth currents and from the mutual interference of departing and arriving impulses in duplex working. Attenuation can be reduced by adjustment of the cable constants, and distortion by the provision of appropriate terminating impedance, but extraneous interference cannot be combated by any such means, owing to its constantly changing intensity and character. It limits the speed of signalling owing to the received impulses necessarily having to be of greater intensity than those arising from the disturbing currents to ensure their identification. The many improvements of terminal apparatus have enormously increased the efficiency of transmission, and it is not unreasonable to assume that the thermionic valve will become as valuable in the domain of telegraphy as it has proved to be in that of telephony.

"Arrival curves" disclose that the speed limitation of long non-loaded cables is primarily due to their failure to propagate the steep fronts of impulses over considerable distances. The Kelvin equation shows that the magnitude of the arrival current depends upon the voltage E and the time-constant CRl^2; reluctance to increase the e.m.f. beyond the 50 or 60 volts normally used, on account of the danger of weakening the dielectric strength of the cable, is doubtless justifiable on the ground of the great cost of repairing faults in transoceanic cables, especially when it is remembered that every 1,000 miles of cable may contain 500 joints, which are generally regarded as a source of anxiety.

Obviously, to reduce the time-constant CRl^2 factor the conductor must be enlarged, the relation between the weight of conductor and dielectric being based on economic as well as mechanical considerations; but arrival curves and tabulated speeds both show that a very substantial increase in size (and correlatively a great increase in cost) is not accompanied by a great improvement in the speed of signalling, and, further, that the rate of improvement diminishes as the size increases. Moreover, a definite limit to the size is the mechanical difficulty of laying heavy cables in great depths of water, and of the still greater problem of successfully lifting them for repair. It is computed that the maximum load which can be absorbed by the brakes of the paying-out mechanism when laying in great depths of water is already closely approached when submerging cables as heavy as 1,100 lb. conductor weight per nautical mile, and no satisfactory method has yet been devised of successfully lifting heavier cables for repair.

The maximum economic size of non-loaded cables has been reached, and it is improbable that any effective modification of the design of such cables will be made until a conductive material having a higher conductivity than copper becomes available, or a suitable insulating material is produced having a lower specific inductive capacity than gutta-percha.

However, a great step forward in the direction of high-speed signalling has been made by the discovery that certain alloys possess special magnetic properties; when applied to the copper conductor in a suitable form they have enabled the theories of Heaviside and other mathematicians to be put into practice. Inductance retards the growth of the current and maintains it when established, so that the arrival curve of an impulse transmitted through an inductively loaded conductor presents a definite wave-front; as only the steep head of each impulse is recorded, the tail being eliminated, signals following each other in rapid succession are thus readily identifiable. As the benefit of too small inductivity is discounted by lower conductivity, better transmission is obtained with copper of a given sectional area alone than a combination of conductive and magnetic material of low permeability. The current in a loaded cable, fig. 1, does not commence until an appreciable time (about 0.49 sec.) has elapsed, but it then rises instantly to a relatively high value; on the other hand, the current in a non-loaded cable, although it commences earlier, rises comparatively slowly to a value sufficient to work the receiving apparatus. These facts illustrate the essential difference between the transmission characteristics of loaded and non-loaded cables, fig. 2. The speed is not affected by the time the signal takes to pass through the cable, but depends only upon the rapidity with which the signals can be made to follow each other while giving the necessary



(*a*) Non-loaded cable; speed 145 l.p.m., the CRl^2 coefficient of 1,090 is attributable to the circumstance that this cable is particularly free from disturbance.
(*b*) Loaded cable; speed 1,000 l.p.m.

Fig. 2.—Facsimile of Messages sent over Fanning-Suva Section of Pacific Cable

legibility at the receiving end; in other words, it depends on the steepness of that part of the arrival curve which is used for recording signals.

Alloys of certain metals of the magnetic group, principally nickel and iron, when appropriately annealed, develop high

* See also Elec. Rev., April 6th, p. 591; 13th, p. 664; 27th, p. 715, 1928.

* British Patent No. 188,688.
† British Patent No. 224,972.

permeabilities with very low magnetising forces; they are known as "permalloy," * "mumetal," † "invariant," ‡ &c., and whilst with comparatively high magnetising forces their permeability is less, or no higher, than that of iron, yet at the lower magnetic intensities it is very much greater. In telegraph transmission the magnetising force due to the signalling current is of the order of 0.00001 to 0.15 gauss, and therefore the alloys exhibit the magnetic permeability necessary to fulfil the requirements of high-speed telegraphy. In addition, it is necessary to exhibit a low hysteresis loss when the magnetising forces and the resultant flux are changed rapidly, and equally necessary for their resistivity to be as high as possible in order to minimise eddy-current loss.

It should be emphasised that the magnetic properties of these alloys depend very largely upon the heating and cooling treatment and upon the mechanical processes which are applied to reduce specimens to a convenient form. The high permeabilities at the lower magnetic intensities are very elusive, and considerably reduced when the material is subjected to mechanical stress, or to the influence of stray magnetic fields. Alloy cylindrical wire or flat narrow tape, of dimensions depending upon the inductance required, is wound helically round the copper conductor and in contact with it. Fig. 3 shows a longitudinal view and cross-section of

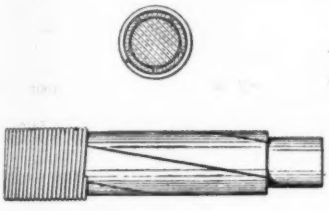


Fig. 3.—Loaded Cable Conductor.

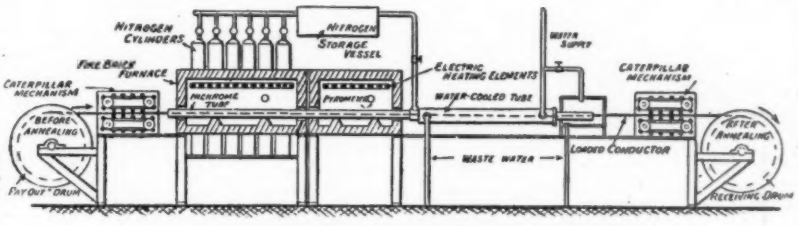


Fig. 4.—Cable Annealing Electric Furnace.

the loaded conductor of the Fanning Island-Fiji portion of the 1926 Pacific cable; the diameter of the copper conductor is 126 mils, the loading consisting of 80 turns of chrome-permalloy wire, 11 mils in diameter, per inch of conductor. Lapping by machines revolving at 1,000 r.p.m. without any allowance for stops, the length of conductor loaded per week of 47 hours is only about 0.5 nautical mile per machine.

Three problems to be solved are: (*a*) The prevention of stresses during the annealing and cooling processes, due to the fact that the rate of expansion and contraction of the loading material differs from that of the copper conductor. (*b*) The restoration of the permeability lost in drawing the wire and in applying it to the conductor. (*c*) The prevention of the reduction of the permeability of the loading material and injury to the copper arising from oxidation and gases formed during the heat treatment.

The outer sheath of strips must not be rolled too tightly round the central wire, so that sufficient space is left to allow the copper to expand and contract without appreciably distorting or stressing the loading material. In the case of a conductor having a diameter of about ¼ in., when no allowance was made for expansion, the inductance of the conductor was from 20 to 30 per cent. below its normal value.

The final heat treatment is of the utmost importance, as the transmission efficiency of the cable is dependent upon it to a considerable extent. The conductors are drawn lengthwise through the furnace at a uniform speed so that all parts of the loading material will be equally acted upon; as uniformity of temperature is essential to ensure uniformity of permeability, an electrically-heated furnace (fig. 4) is arranged for accommodating five conductors simultaneously. The five heating tubes, each taking one conductor, are made of nichrome and are about 14 ft. in length, and a thermostat maintains the temperature within very close limits. Caterpillar mechanisms prevent any stress being transmitted to that portion of the conductor within the tubes. An important feature is the provision of means of preventing oxidation of the loading material and of removing any gases which may be formed by the presence of oil, grease, or carbonaceous matter, which render the metal brittle, in addition to lowering its conductivity. A stream of inert gas, such as nitrogen, is forced through the heating tubes in a direction opposite to that in which the conductors are moving, thus sweeping away gases generated in the furnace. It is important to use nitrogen of a high degree of purity and, although it is impracticable to eliminate all traces of oxygen, means must be adopted to exclude hydrogen entirely, on account of its deleterious effect on the copper conductor. Failure of the supply, even though temporary, will result in the copper becoming brittle and liable to fracture during the subsequent cable-making processes, and lower the permeability of the loading material.

The usual method of filling the interstices of stranded conductors with Chatterton's compound are ineffective, due to the intervening close winding of loading material and to the necessity for the operation being performed subsequent to the heat treatment. The compound is necessary for securing adhesion between the conductor and the dielectric, and for eliminating air which would otherwise become a source of trouble during the subsequent insulating process and when the cable is subjected to hydrostatic pressure. The method used is, therefore, analogous to the vacuum drying and impregnating of paper-insulated cables, and such compounds as refined bitumen of natural origin, which remain relatively fluid at temperatures and pressures encountered at great depths of water, are used to ensure equalisation of pressure upon all portions of the loading material. Fig. 5 is of unusual interest; the tests were made whilst the temperature was maintained at 2 deg. C., approximately the mean of the Pacific Ocean at depths exceeding 2,000 fathoms.

Alloys of high permeability are easily magnetised by comparatively weak fields. If the loaded conductor in the process of manufacture passes through any stray fields, the inductance (generally lowered) can be restored by demagnetisation by passing through the conductor an alternating current which is gradually reduced to zero; the inductance is rendered more uniform by this means.

The only insulating material seriously considered for submarine work is gutta-percha.

The subsequent manufacturing processes which convert the core into cable are identically the same as those employed in the manufacture of other types of cable.

The basis of electrical design of telegraph cables (the original paper outlines the governing factors) shows that, as the ratio of sent to received current is large, a high degree of balance in the Wheatstone bridge arrangement is essential for duplex working; the impedance of the artificial line must simulate that of the cable to within one part in 100,000, and the close balance must be maintained over the range of frequencies and magnitudes of current.

The greater the distance of a change of character from the end, the less is its effect, and one remedy proposed is to have the end-sections of the cable non-loaded and gradually to increase the inductance towards the middle in order to obtain a smoother impedance/frequency curve showing less variation with current. Up to the present, however, no successful method of duplexing cables loaded throughout their length has been evolved.

The electrical tests required for a loaded cable involve several additions to the standard methods hitherto in use for non-loaded telegraph cables, as the usual direct-current tests are supplemented by alternating-current measurements. Such tests have been fully developed for telephone cables for the range of voice frequencies, *i.e.*, 200-2,000 cycles per sec., and (described in textbooks and other publications) have been adapted with little change for telegraph cables, the principal difference being the lower band of frequencies used, *viz.*, 10-100 cycles per sec. In the factory, measurements of inductance and effective resistance are made at various stages of manufacture, *e.g.*, on the loaded conductor after annealing and again after covering with the dielectric.

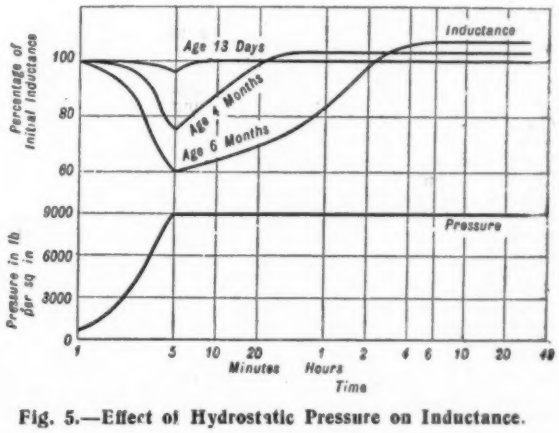


Fig. 5.—Effect of Hydrostatic Pressure on Inductance.

The magnetic properties of the new loading materials being very susceptible to mechanical pressure and the dielectric affected both by temperature and pressure, it therefore becomes

important to test the loaded and covered core under the conditions that exist at great ocean depths. A sample of core about 100 ft. in length is placed in a steel tube which is in the form of a U contained in a tank supplied with brine from a refrigerator so that the whole can be kept at the desired low temperature; the tube is filled with water, pressure of which can be adjusted and maintained at any value up to 4 tons per sq. in., and through suitable glands the core can be connected to the testing bridges.

The transmission time between Fanning Island and Suva on the loaded cable was 0.467 sec. From this it was deduced that the inductance of the laid cable was not more than 5 per cent. below the values measured in the factory. Confirmation was provided by an experiment in which a ¼-mile length of cable was laid at a depth of 2,000 fathoms. It was subsequently lifted, coiled again in the ship's tanks, and brought back to the factory in England. The measurements given below show that the inductance was not appreciably affected by the operations of laying, picking up and turning over.

	Inductance per nautical mile.
Before laying	157.1 mH
After laying, picking up, &c.	154.6 mH

It has been computed that a loaded cable capable of transmitting 1,000 letters per minute in one direction over a distance of 2,000 miles would involve only half the capital outlay needed for a system of non-loaded cables of equal transmitting capacity, *viz.*, 500 letters per minute in each direction simultaneously. Moreover, investigation reveals that when high transmitting speeds are assumed, or when greater distances have to be spanned, even larger savings would be effected by adopting the loaded type of cable.

On the other hand, it may reasonably be urged that, in view of the liability to interruption of submarine cables, the wisdom of installing single units of large capacity is open to question and, therefore, the apparent advantage of loaded cables based on initial outlay only may be over-estimated. As a rule, the failure of a non-loaded cable causes no serious interruption of the service, as alternative lines are generally available, but in the event of the cable being one of high speed, working at full capacity, very serious congestion and delay will arise when a breakdown occurs, unless the alternative lines are equally efficient.

It would appear that the only satisfactory solution of this problem, which does not become acute until the cables are worked to full capacity, will be the provision of a duplicate cable.

The result of lower capital and working costs must be substantial adjustments of cable rates, but although reductions have been made since the arrival of loaded cable, much remains to be done in this direction. Obviously the development of the overseas telegraph habit can best be fostered with the powerful aid of cheap rates.

TABLE I.

Continuously Loaded Submarine Telegraph Cables.

Date.	Position.	Length, in nautical miles.
1924 ...	New York-Azores	2,329
1926 ...	New York-Bay Roberts ...	1,344
	Bay Roberts-Penzance	2,023
1926 ...	Freemantle-Cocos Island ...	1,800
1926 ...	Emden-Azores	1,884
1926 ...	Bamfield-Fanning	3,466
1926 ...	Fanning-Fiji	2,054
1928 ...	Bay Roberts-Azores	1,341

The authors thank Messrs. Siemens Bros. & Co., Ltd., for permission to use some of the information contained in the paper.

Discussion in London.

Mr. H. D. WILKINSON said the authors had rendered a service by publishing facts and figures. The importance of loading was such that no unloaded cable longer than 2,000 miles would be laid in future. The speed of signalling had been increased seven times, but it could be made 11 times. Vital questions were: could a loaded cable be duplexed and repaired in deep water? Duplexing difficulties still existed, but were being attacked. The loading wire was as fine as a hair (No. 32), and its magnetic properties were the same as those of rings round the conductor; it could be broken for a few inches for repairs and left disconnected, as the inductive wrapping need not be continuous. The statement that the speed of manufacture was only 0.5 mile of cable per week per machine might be misleading, for it depended on the number of machines employed; the normal rate was about 300 nautical miles per week. The permeability of the new alloy was extraordinarily susceptible to weak magnetic influence; the production of very pure metal in high-frequency induction electric furnaces and its progressive annealing was the only method of making it.

Mr. W. T. PALMER thought that a similar comprehensive paper on loaded telephone cables would be of even wider interest. The authors' footnote stating that in the case of an actual cable the arrival current "does not rise instantaneously, and the 'head' has a finite slope; . . . " left one in the dark, so he showed lantern slides which indicated the slope.

Mr. H. C. CHANNON pointed out that of the eight cables named in Table I, six were made by the Telegraph Construction & Maintenance Co., Ltd.; half of them were loaded with the new alloy and the last one was capable of considerable duplexing. His company had, with present materials, developed a cable suitable for simultaneous transatlantic telephony and telegraphy. The future of such cables was very bright.

Mr. LL. B. ATKINSON marvelled at the manner in which an arrival current curve with a steep rising front was obtainable at the end of a long cable after a definite time interval. Having been shown how to load a cable, they had had to wait 40 years for the production of suitable material with which to do it. Immense skill had been evinced in making use of the new alloys, which had to be handled with extraordinary delicacy.

Mr. A. B. HART said he seemed to have heard lately that transoceanic cables were bad stock and would be given away shortly, but the facts contained in the paper had corrected that impression. He drew attention to the wide field that existed for the use of short-distance cables, in European waters, for instance. Telephone men had pitied telegraph men, who seemed to be "stuck in the mud," and apparently took no advantage of what was beneath their noses; but they were now working together, many of their problems being similar. International telephony had now necessitated the construction of lines within transoceanic distance, of course, with the aid of repeaters, and if cables could be designed to transmit speech over such distances, they would also make the best possible telegraph cables. There appeared to be a tendency to swing back from continuous loading to coil loading, but there were fields for both, and the former could be utilised for simultaneous telephony and telegraphy, which was an advantage.

Mr. W. M. MORDEY remarked that they had that night an opportunity of recognising what was probably the greatest electrometallurgical achievement since Faraday's time. Messrs. H. D. Arnold and G. W. Elmen, who discovered and made "Permalloy," would be known as the greatest pioneers of their time; the results of their work could be reckoned in tens of millions of pounds sterling, for they had rendered great service to humanity. In his experiments with iron and nickel, Dr. John Hopkinson must have made the new alloy, without knowing it. Its permeability was so high that it was actually saturated in the earth's field.

Mr. H. KINGSBURY pointed out the extraordinary advance which the paper represented. They were more or less embarrassed by the speed at which loaded cables were capable of operating, and they had not yet got terminal apparatus which would handle the maximum speed of transmission that such cables were capable of. His company operated several of the cables mentioned in Table I, and few of them were doing their utmost. He could not appreciate the authors' contention that the size of cables was limited by the gear used for laying them; that was a difficulty that would have to be overcome for telephone work. Cable manufacturers passed over too lightly some things that had been good enough in the past, but would not be good enough in future. A loaded cable was really a "bunch" of cables and its very great value made it necessary to aim at greater security than ever. Some form of non-corrosive armouring was needed.

Comm. R. APPLEYARD supported the authors' statement that there was nothing at present to supersede gutta-percha as an insulator of submarine cables, but it was by no means the same substance to-day as it was years ago; it had been improved, and its many grades was indicated by prices in 1914, which varied from 10d. to 240d. per lb. The "sea return" conductor was a problem that needed study.

Mr. E. S. RITTER commenced to discuss the fact that various frequencies attenuated differently, and travelled with unequal velocities, but had not time to develop his argument.

Dr. A. ROSEN, in reply, explained that loaded-cable repairs could be effected in almost the same way as those of ordinary cables, the loading not being carried over each joint. Lifting had had little effect on cables so far, but lifting heavier ones would involve greater risk; it was a question of safety factor. Wire loading was superior to tape wrapping, as the former exhibited less effect in the earth's field.

Electric Vehicles in France.

At the French Commercial Motor Vehicle Exhibition just held in Paris only one electric vehicle was on view, the remainder, with the exception of two fitted with Diesel heavy-oil engines, being of the petrol-driven type. The electric machine was a 5-ton truck made by the Société Sovel des Véhicules Electriques Industriels, of Paris; it is equipped with two motors, which drive the rear wheels through enclosed reduction spur gearing and side chains. The speed controller is adapted to give five forward speeds. The battery is carried in trays below the centre half of the chassis, the trays being so mounted that by means of a crank handle they can be moved outwards to give ready access to the cells. Another feature of the vehicle is the neat arrangement of the wiring, the cables from the controller at the front to the motors at the rear being enclosed in two long steel tubes.

Prosperity and Progress in France.

Annual Review by Mr. J. R. Cahill, Commercial Counsellor in Paris.

WE have previously stated that the best of the Department of Overseas Trade reports, from the electrical point of view, are those compiled by Mr. J. R. Cahill, C.M.G., Commercial Counsellor at the Paris Embassy. The latest one, covering the current year (Stationery Office, 5s. net), contains even more electrical information than usual. Consequently we can only deal in the merest outline with the matters treated in the report.

In his introduction, Mr. Cahill draws attention to the remarkable level of prosperity which France has reached since she recovered from the depression of 1920-21, and effected the stabilisation of the franc. The economic power of the country has been considerably reinforced by the energetic measures taken by the Government to develop the national resources and equipment, facilitated by the large deliveries of material under the Dawes Scheme. These developments include the construction of hydro-electric undertakings, the provision and laying of long-distance telephone cables, &c., as well as the stimulation of the use of electricity and the electrification of railways. The "rationalisation" of industry has made marked headway and standardisation has also advanced in a number of industries, including the production of electrical material. A few concerns dominate the latter industry, and the same is true of the production of electricity. The result of this concentration is a growing suppression of competition and the slower movement of decline in prices.

The Electrical Industry.

As has been mentioned, combination in the French electrical manufacturing industry has reached an advanced stage. Three or four groups have each under their direct management a number of factories and have acquired control or large interests in other factories; they also appear to work in close understanding, at least as regards several matters. Moreover, they are heavily interested in undertakings producing and distributing electricity, and those who are large consumers of power. The dominant concern is the Thomson-Houston Co. (capital 300 million fr.) which has many ramifications in other than purely manufacturing fields, *e.g.*, in the Union d'Electricité (capital 200 million fr.). It also works on friendly terms with the Cie. Générale d'Electricité (capital 100 million fr.), and has a working agreement with the Construction Electriques de Jeumont, which, in turn, has wide interests. The importance of the Thomson-Houston group will be enhanced by the recent agreement with the Société Alsacienne de Constructions Mécaniques which involves the formation of a new company with a capital of from 400 to 450 million fr., to take over certain branches of the companies' activities. Another important concern is the Cie. Electro-Mécanique, which has connections with the Metropolitan-Vickers Electrical Co., Ltd., and the Swiss Brown, Boveri Co.

Radio Apparatus Production.

The manufacturing of radio apparatus has attained considerable dimensions. The value of the 1926 production was estimated at 325 million francs, of which valves accounted for 157 millions. The capitalisation of the industry is put at between 500 and 600 million francs, and about 30,000 people are employed. The predominating concern in the industry is the Cie. Générale de Télégraphie Sans Fils (capital 68.75 million fr.), which has six affiliated companies in France with a combined capital of a further 102 million fr. and holdings in at least eleven companies in Belgium, Italy, Spain, Czecho-Slovakia, Austria, Brazil, Chile, China, &c. The company is also interested in broadcasting and carries out extensive experimental and research work. In 1926 the Cie. Radiotechnique, one of its subsidiaries, manufactured 2,200,000 receiving valves and 100,000 kW of transmission valves. Another subsidiary, the Société Française Radio-Electrique, received in February last an order for 60 500-W transmission sets for the French Admiralty. There are two much smaller groups with interests in common, as well as several large individual concerns. One of the most successful foreign manufacturers in France is the Dutch Philips Company. Two important British concerns manufacture in France and in some districts a considerable number of British and American accessories are sold (particularly loud-speakers). The uniting of two pre-existing trade associations to form the Syndicat Professionel des Industries Radio-Electriques has created a body representing over 98 per cent. of the production.

Imports and Exports.

Exports of electrical machinery and apparatus have made steady progress since the war, from a pre-war figure of 10.2 thousand tons to 12.4 in 1921, 23.6 in 1924, and 24 thousand tons in 1927. Imports are now lower than before the war; from 7.6 thousand tons in 1913 they rose in 1921 to 12.2 thousand tons, but in 1925 and 1926 they receded to 7.8 and 5.9 thousand tons respectively. The most important pre-war supplier of France was Germany, with 2,123 tons of heavy machinery (48 per cent. of total French purchases from abroad), 702 tons of electrical apparatus (53 per cent.), 73 tons of lamps (64 per cent.), 335 tons of cables and wire (85 per cent.), 165 tons of batteries and accumulators (~0 per cent.), and 804 tons of insulating material (67 per cent.). In 1926, the latest year for which detailed figures are yet obtainable, German heavy machinery supplies had declined to less than 685 tons, and represented only 24 per cent. of total French imports under this head, while in the other groups she had been almost eliminated from the French market. It remains to be seen to what extent this decline will be modified as a result of the more favourable terms obtained by Germany under the new Franco-German commercial agreement, and by the increased utilisation of German machinery and supplies as deliveries in kind under the Dawes Plan.

French exports of radio apparatus at present considerably exceed the imports, but according to the trade returns for the last two years (prior to 1926 radio apparatus was not distinguished separately in the trade returns) imports are increasing and exports decreasing. Imports of valves amounted in 1926 to 5 metric cwt., with a value of 137,000 fr., and in 1927 to 216 metric cwt., with a value of 3,294,000 fr.; exports of these goods were respectively 636 and 238 metric cwt., with corresponding values of 4,793,000 fr., and 4,480,000 fr. Imports of appliances and accessories other than valves amounted in 1926 to 98 metric cwt., value 693,000 fr., and in 1927 to 279 metric cwt., value 3,503,000 fr.; exports of the same commodities were in 1926, 13,100 metric cwt., value 123,618,000 fr., and in 1927, 7,335 metric cwt., value 33,092,000 fr. For the first five months of 1928 imports of radio apparatus other than valves have taken on an extraordinary expansion, no less than 2,113 metric cwt., value 8,362,000 fr., having been imported; exports have declined further, being only 3,010 metric cwt., value 15,010,000 fr. No comparison can be given for valves, as their identity has been merged, under the new customs classification, in that of incandescent electric lamps in general.

Electric Power Production.

The total capacity of French power stations at January 1st, 1926, was 5,069,000 kW, of which 3,229,000 kW was thermal and 1,840,000 kW hydro-electric; by the end of the year the two classes had risen to 3,500,000 kW, and 1,900,000 kW respectively. France has two of the largest generating stations in the world, those of St. Ouen (400,000 kW) and Gennevilliers (350,000 kW). The capacity of the station at Commines in the Nord is being raised from 85,000 to 150,000 kW; other important undertakings are Vitry-sur-Seine (100,000 kW), Sainte-Tulle (Lower Alps) (60,000 kW), and Wasquehal (Nord) (56,000 kW). Extra-high-pressure transmission lines operating at 100,000 V or more have a length of 2,250 miles (including 250 miles at 150,000 V between Bordeaux and Toulouse). There are 4,378 miles of lines operating at between 45,000 and 100,000 V; and medium and low-pressure lines are put at 46,875 miles, serving 70 per cent. of the population.

Water Power Development.

Several pages of the report are devoted to hydro-electric schemes. It is shown that the progress in this direction has not been so great as in the case of thermal power stations. The reasons for this are the high capital costs involved and the reluctance of investors to take long-term fixed interest securities, coupled with the fact that the prices for energy are State controlled. Accordingly the Government has had to encourage development by means of annual subsidies (8.5 million fr. in 1927), and grants to research bodies. A new scheme aims at the subsidising of hydro-electric enterprises to the extent of 2 per cent. of the capital through a period of 15 years. The enterprises must be commenced before January 1st, 1930, but the uncompleted portions of existing schemes would be eligible for grant. The Government would receive ordinary shares to the extent of its participation, giving it some measure of control. The State has also encouraged rural distribution (upon which the success of water-power schemes often depends) by granting loans at low interest rates, &c. At the commencement of 1927 the total capital invested in the hydro-electric industry was 4,458 million fr. and the total capacity of the plant installed was estimated at about 2 million kW. The available resources are computed to be 6,750,000 kW. There are 213 stations with a capacity of over 1,000 kW and 42,000 with lower capacities. The largest stations are those at Brommat (Aveyron), 75,000 kW, Bancairon (Alpes-Maritimes), 45,000 kW, and Eguzon (Indre), 40,000 kW; there are three others of 35,000 kW each. At the beginning of 1927 works representing about 325,000 kW were in progress, while during the year 137,000 kW of plant commenced operation. It was expected that another 54,370 kW would be put into commission during the current year. The development in the Pyrenees, which is largely bound up with the electrification of the Southern Railway, is continuing. The railway company already derives power from three stations, another has been completed, and a further one was expected to commence work-

ing before the end of this year. Plans have been prepared for six more stations in the upper valley of the Têt and the Upper Ariège valley. The Union of Producers of Electricity of the Western Pyrenees has a widespread network fed from 16 stations. In the Eastern Pyrenees electrification has not proceeded so rapidly, but the Alais-Froges-Camargue aluminium company has developed and is developing the water power of the district. Hydro-electric work has also proceeded in the Alpine districts, and several stations of a fairly large nature are in course of construction. In March last a law was passed by which the necessity for special Acts for the importation of deliveries in kind under the Dawes Scheme for constructional works was abandoned in favour of authorisation by ministerial decree. It is considered that this may pave the way to a resumption of work on some important hydro-electric undertakings which have been held in abeyance for financial reasons. One of these is the River Truyère project in the Massif Central upon which 75 million fr. has already been spent, a further 350 millions being required. Several other suspended schemes are also mentioned in this connection.

Passing reference is made in the report to the Aber Vrac'h and other tidal-power schemes, as well as the invention of M. Georges Claude for utilising the difference of temperature of the sea at different levels.

Railway Electrification.

The electrification of French railways has made great headway, particularly in the case of the Midi or Southern Railway. In April, 1927, this company stated that electrification was saving it 130,000 tons of coal per annum, most of which was imported, and the subsequent electrification of the 166 miles from Bordeaux to Hendaye has probably increased the annual saving to 200,000 tons. The Midi Company now operates 500 miles of its system electrically. The Paris-Orléans Railway takes second place with 144 miles of electrically operated lines. The Paris-Vierzon section represents the bulk of this (127 miles) and carries a sixth of the company's total traffic. Electrification is said to result in an annual saving of 250,000 tons of coal. The State Railway has electrified the Paris suburban lines, and a small stretch has been converted by the Paris-Lyons-Mediterranean Railway. When the great hydro-electric projects connected with the construction of the great canal of Alsace from Basle to Strasbourg are completed no doubt the Alsace-Lorraine system will be electrified. The total length of electrified lines is given as 716 miles, and according to a statement of the Minister of Public Works early in 1928 there was an annual saving of 500,000 tons of coal out of a total consumption of 12 million tons. The Government has announced its intention of giving the fullest encouragement to railway electrification, and some years ago agreed upon a progressive scheme with the railway companies. The Midi Company aims at the conversion of a further 687 miles during the next five years, at a cost of 500 million fr. It is intended to take part of the necessary equipment (to the value of 190 millions) as deliveries in kind from Germany. The electrification of 222 miles is to be proceeded with immediately. The programme involves the construction of three or four new generating stations. The Paris-Orléans Railway is proceeding slowly with its scheme, and the P.L.M. Company is commencing at an early date the electrification of the line from Cannes to Grasse.

Communications.

The extension of the telephone system has adversely affected telegraph traffic which has been considerably reduced in spite of the extension of the system. Two important telephone developments which have been proceeding in recent years are the automatic system and the laying of long-distance multi-core cables. Under the 1922-26 programme cables have been laid between Paris and Mulhouse, Lille and London (*via* Boulogne). Sections of the Paris-Marseilles and Paris-Toulouse cables have also been installed. The telephone systems in Dieppe, Havre, Nantes, Orleans, Marseilles, Colmar, and Nice, have been converted to automatic working and partial conversion has taken place in Paris, Bordeaux, and Lyons. The programme for Paris aims at the completion of the 40 necessary exchanges by 1940 at a total cost of 2,000 million fr. In March last a telephone service was established between Paris and the United States and Cuba. In the same month radio-telephone messages were sent from Paris to Algiers on a 30-metre wavelength. Communication with North Africa is to be improved by the laying of a second cable from Marseilles to Bizerta (Tunisia); the cost of this (10 million fr.) is to be borne equally by the French and Tunisian Governments. Improvements have been made in connections with Italy and Spain, and in May last a service between Paris and Lisbon was opened.

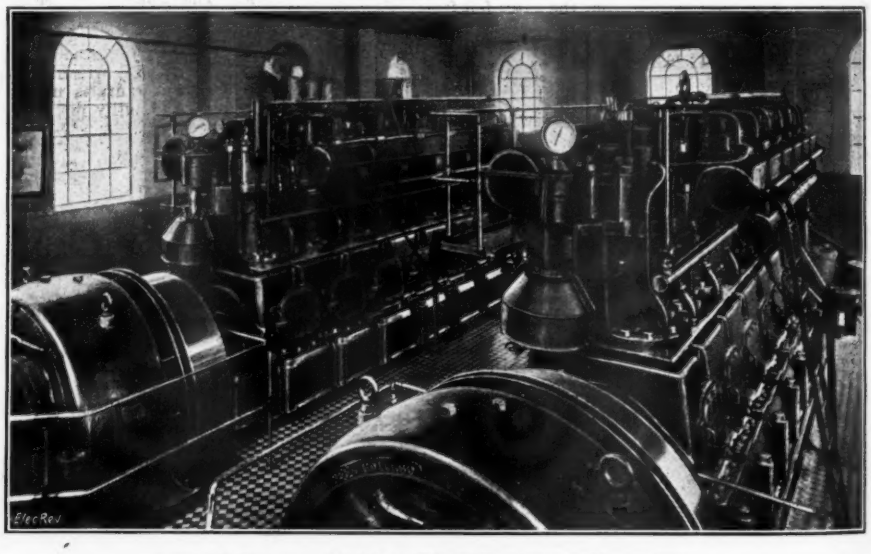
With regard to broadcasting, a law was passed in March enabling the Government to sanction the continuation of the existing stations, without alteration in the conditions of working, until the "organic law" on the radio system is passed. It is prescribed that all stations erected since January 1st, 1928, must cease working, and all stations which have made alterations since that date must revert to the pre-existing state. A scheme evolved in 1926, but not yet ratified, provided for three great national stations and 18 regional stations operated by the State or for the State. It is foreshadowed that in 1933 the State, or a "National Radio Office," will become the owner of all French broadcasting stations.

Electricity Supply at Shrewsbury.

A second 400-kW Diesel-electric set has been installed at the electricity works.

IT will be remembered that a full description of the "Belliss" four-stroke-cycle high-efficiency Diesel oil engine was given in the ELECTRICAL REVIEW of November 19th, 1926, when the first 400-kW set for the Shrewsbury Corporation Electricity Works was undergoing its official trials at the works of Messrs. Belliss & Morcom, Ltd., Birmingham. The performance of this engine has justified the purchase of a duplicate set, which has just been put into commission.

The first engine was started up in January, 1927, and has therefore been running for 22 months. During this time it has generated over two million kWh, and frequently has taken the whole load of the electricity supply. Examination and cleaning of the pistons and cylinders was undertaken only after the engine had been on load for nearly 5,000 hours. There are "Belliss" open-type Diesel engines also at work in the same station, and the average fuel consumption for the whole installation for the year ended September 30th, 1928, has been 0.696 lb. per kWh, whilst the lubricating oil consumption for the whole station has averaged 0.007 lb. per kWh. The fuel consumption of the high-efficiency engine alone has averaged 0.671 lb. per kWh.



Belliss & Morcom 600-b.h.p. Diesel Engines at Shrewsbury.

The Shrewsbury Corporation Electricity Department is in a very sound condition, and has been able to give to its customers two reductions in charges during twelve months, as a result of which the charges for heating, cooking, and power are now 1d. per kWh, with a 10 per cent. discount to users of over 1,000 units per quarter. For lighting, the flat rate is now 3d. per kWh. In the recent report of the Electricity Committee attention was drawn to "the substantial economies resulting from the installation of the oil-driven generating plant." Although the first reduction in charges was made after the first quarter of the previous financial year, the report shows a profit of £5,473, and a surplus of £'4,2'6 on net revenue account. Mr. C. M. Johnston, M.I.E.E., M.I.M.E., is the electrical engineer and manager. All the steam and oil plant in the station since its inception in 1898 has been built by Messrs. Belliss and Morcom, Ltd., and the dynamos by Messrs. Thomas Parker, Ltd., and the Rees Roturbo Manufacturing Co., Ltd.

Tramways and Light Railways in 1927-28.

The Ministry of Transport's Annual Returns.

THE annual returns of street and road tramways and light railways and railless trolley undertakings for 1927-28 are now obtainable from the Stationery Office (15s. net). During the year (ended December 31st, 1927, for companies, and March 31st, 1928, for most municipalities) the number of tramway undertakings was reduced to 233 by the absorption of the Hurst Council's undertaking by Ashton-under-Lyne and the cessation of operation by the Wolverton and Stony Stratford Tramway (L.M.S. Railway Co.). During 1927 the West Hartlepool and Chesterfield municipal undertakings went over to railless traction while those of the Matlocks and Rowley Regis Urban Councils ceased operation. Operation of the following company tramways also ceased: Burton and Ashby (L.M.S. Railway), Camborne and Redruth, Glossop, and Wrexham and District.

The total capital of local authority undertakings at the close of the year was £82,836,967, of which £44,666,908 had been redeemed or provided for, leaving a net capital liability of £38,170,079, against £37,926,995 in 1926-27. The companies' paid-up capital was £21,087,691, and the net capital liability £19,791,476, against £19,967,096. The total capital expenditure amounted to £99,913,760 (local authorities £80,312,134; companies £19,601,626). The gross receipts of the municipal undertakings rose from £23,060,376 to £23,860,767, while the working expenses fell from £.8,793,121 to £.8,663,222, increasing the net receipts from £1,267,255 to £5,197,545. In the case of the company undertakings the receipts rose from £3,856,159 to £3,890,737, and the working expenses declined from £3,335,340 to £3,279,925; the net receipts were thus increased from £520,819 to £610,812. There was accordingly an all-round improvement in the ratio of working expenses to receipts, from 81.50 to 78.22 per cent. for municipalities, from 86.49 to 84.30 for companies, and from 82.21 to 79.07 per cent. overall. The improved position of the municipal undertakings is apparent from the fact that the total amount received from the rates was reduced from £655,242 to £552,754, while the total contribution to rate relief was £420,011 against £334,080; thus the net amount drawn from the rates fell from £321,162 to £132,743.

The total net income of tramways, after the necessary adjustments, was £6,916,388, as compared with £6,113,163 in the preceding year. With the sums brought forward from the previous year and, in the case of local authorities, the sums transferred from other businesses, the total amount available for distribution was £6,973,975 (against £6,318,727). Of this sum £1,954,682 (£2,058,277) was appropriated for interest charges and dividends; £2,240,441 (£1,917,281) for repayment of debt; and £1,724,237 (£1,413,225) for reserve and renewal funds, while, in the case of companies having other businesses, £217,802 (£182,021) was available from tramways for purposes of appropriation under various heads.

In accordance with practice the 154 municipal undertakings which earned income during 1927-28 are grouped according to financial results, the position for the past seven years being shown in a table. The undertakings which showed a credit balance after meeting all charges, including capital redemption and reserves, numbered 93, against 82 in 1926-27. Those whose appropriations to reserve, after meeting all charges, exceeded the amount available from the year's working numbered 10 against 14. There were 14 undertakings (against 19) which, after meeting interest and capital redemption, were unable to meet fully income tax and other appropriation charges. The fourth class which, after meeting interest charges, were unable to meet capital redemption in full, included 25 undertakings (against 17). Five undertakings (against 13) were unable to meet interest charges in full, and seven (against 11) were unable to cover their working expenses. The total result was a debtor balance of £16,302, as compared with £529,335 in 1926-27.

The total route-mileage open for traffic was 2,514 (municipalities 1,850 miles; companies 664 miles). Of the total 2,491 miles was electrically-operated and 1,539 miles was standard gauge. The number of passengers carried during the year was 4,705,842,932, an increase of 245,544,255, or 5.51 per cent. The car-mileage was 396,554,545, an increase of 17,803,845 car-miles, or 4.70 per cent. Of the total 395,270,534 car-miles (99.68 per cent.) were "electric." The quantity of electricity used was 794,175,338 kWh, and the amount per car-mile averaged 2.01 kWh; these figures compare with 738,934,476 and 1.96 kWh respectively in 1926-27. The average fare paid per passenger fell from 1.42d. to 1.39d. Full financial and statistical details of each undertaking are given in the returns.

As regards railless trolley systems it is stated that at the end of the period under review the undertakings of 20 local authorities and one company were open for traffic. Twenty-one municipalities and one company had the necessary powers, but did not exercise them. Aberdare Urban District Council abandoned its powers during the year; the undertakings of the Colchester and Wallasey Corporations and the Hastings Company appear for the first time; and three systems, those of Nottingham, St. Helens, and Chesterfield Corporations, commenced operation. The capital expenditure rose from £757,484 to £1,050,714 (municipalities £1,018,785); the gross receipts from £286,391 to £496,019 (municipalities £491,272); working expenses from £249,985 to £381,891 (municipalities £375,507); the net receipts from £36,436 to £114,128 (company loss of £1,637). The ratio of expenses to receipts was reduced from 87.28 to 76.99 per cent. The route-mileage open for traffic was 111.34 (against 87.04); the number of passengers carried rose from 50,382,193 to 80,112,970 (municipalities 79,138,846); the car-mileage from 5,092,956 to 8,823,076; and the electricity consumption from 7,566,147 to 12,291,712 kWh. The energy consumed per car-mile was slightly reduced—from 1.49 to 1.48 kWh.

Standardisation.

The process of preparing a British Standard Specification and some trains of thought arising therefrom.

By S. H. Holden, M.I.E.E.

(*Extracts from Chairman's Address before the* SOUTH-MIDLAND CENTRE *of the* INSTITUTION OF ELECTRICAL ENGINEERS *at Birmingham.*)

THE preparation of a British Standard Specification is initiated as follows: in the first place, an intimation must be sent by some responsible group of persons interested in the matter to the Permanent Committee of the British Engineering Standards Association stating that a specification is desirable. Any society, institution, or group representing either makers or users, may take this initiative, but the B.E.S.A. makes an absolute rule never to take the initiative itself. If the B.E.S.A. Committee is satisfied that a specification is likely to be useful to all parties concerned, a sub-committee is set up consisting of people who may be regarded as fairly representative of makers and users, together with representatives of Government Departments, Scientific Research and Standardising Institutions, who may have a direct interest, and who watch over the interests of the general public. The Sub-Committee generally starts by considering proposals put forward by the persons who first asked for its appointment; in this way a draft is prepared and may then be sent to the different bodies interested, who, in time, return it with suggestions, which are considered by the Committee. Second and third drafts may be prepared in a similar way, and only after lengthy discussions and compromises is a draft finally approved for issue and printing. The same procedure is followed when a suggestion is made that some existing Standard Specification requires revision.

The spirit in which the B.E.S.A. does its work is thoroughly English. In some other countries the standardising authority makes the first move and produces, with the aid of experts, a Standard Specification, only to find in the end that nobody wants it, or will use it. Some 300 specifications have already been issued by the B.E.S.A., and necessarily contain a large number of figures representing dimensions, quantities, or weights. Universally accepted standards of weight and measurement are therefore a fundamental necessity: in addition, the means of comparison of the standardised article and the fundamental standards must be capable of accurate execution, for it is of no use specifying that a certain article must have certain dimensions, or a certain composition, if it is not possible to ascertain readily whether it does, or does not, comply. Of course, no two articles are ever alike; all we can do is to make the best possible approximations. An important part of every B.E.S. Specification, therefore, consists in laying down limits of error, or tolerances, which must not be exceeded. They often involve protracted discussion before they can be decided upon, and are revised from time to time as the skill of manufacturers increases and the users demand; but alterations of specifications can only become operative so far as makers and users are substantially agreed that they will be possible to produce and advantageous in operation; their usefulness would diminish at once if any attempt were made to set up some ideal which would not satisfy both.

One reason for our continued adhesion to the English measures is their human association, their direct relation to elementary dimensions. A large number of decimals are merely translations of vulgar fractions: many percentage errors, or tolerances, given as 2.5 per cent. or 2.25 per cent. might just as well be 2.6 per cent., 2.3 per cent., or 2.2 per cent., but for our delight in halves and quarters. B.S.S. 110/21 gives dimensions in inches, such as 7/16, 1¼, ¾, &c. B.S.S. 91 gives in one table some dimensions in decimals of an inch, and others in vulgar fractions. Consistency is sometimes treated with more consideration than it deserves, and in the wrong way. It is a useful rough test for many purposes, and may call attention to matters that require alteration, but I have little use for those who aim at consistency for its own sake as if it had some magic virtue. The mixing together of decimal and vulgar fractions is inconsistent, but is it wrong? For the purposes of the Engineering Standards Association both should be retained, for some quantities are best dealt with in one way, some in others, and consideration

must be given to those who habitually employ them; but the inconsistency of mingling decimal and vulgar fractions in one specification, and for similar purposes, shows lack of care in compilation. It is objectionable because the user of the specification has to frequently translate from one system to the other when comparing quantities which they express. A useful rule would be that all percentages should be expressed in decimals. Consistency, followed for its own sake, may easily become a vice.

Another aspect of the subject is the possibility of overdoing it; while perhaps not necessary, a certain amount of variety may be better than entire uniformity; in other words, by overdoing standardisation we may defeat our object by taking away the attractiveness of the finished article. This is unlikely to occur in the electrical industry, except possibly so far as electric-light fittings are concerned.

Engineers are gradually applying, with great advantage, many of the principles long known to the older profession of architects. Designers of modern power plant are anxious to add dignity to their work by allowing the best architects to have some voice in the lay out, and by housing their machinery in buildings which, losing nothing of interior suitability, are themselves objects of beauty which any community may be proud to possess; some of the continental nations are ahead of us in this respect.

The opposite tendency is that of dispensing with buildings and architecture altogether, thus producing what is typified by the outdoor sub-station, an abomination in my eyes. In the near future many hundreds of sub-stations will be placed in our villages: let us have the decency to clothe them appropriately, rather than associate electrical distribution with naked ugliness wherever it goes.

To sum up my somewhat rambling remarks: standardisation as carried out under the auspices of the British Engineering Standards Association is a useful and necessary means of obtaining a combination of goodness and cheapness, so long as it is kept within due limits. It should be confined to the specification of the quality of raw materials, such as iron, copper, and gold; the quality and dimensions of subordinate articles, such as screws, rails, and wire; and almost confined to performance in the case of complicated finished articles, such as electricity measuring instruments, generators, and transformers. Where a finished article, or part, is visible and does not have to fit into anything else, variety should be encouraged and standardisation avoided so far as possible. When a standard specification deals with a complete article, it should provide that the materials and the subordinate articles, if any, used in its manufacture should each comply with the appropriate B.E.S. Specification, if it is to be claimed that the finished article is made in accordance with B.E.S.A. provisions.

Low-Temperature Carbonisation.

Report of a meeting of the London Local Technical Group of the Electrical Power Engineers' Association.

AT a meeting of the London Local Technical Group of the Electrical Power Engineers' Association, held on November 27th, Dr. A. T. Demouilpied discussed the problem of low-temperature carbonisation of coal and its industrial applications, particularly in the power house. He emphasised that low-temperature carbonisation was not the art of getting something for nothing. It did not claim to be the panacea for the present ills of the mining industry, though he firmly believed it would prove to be a real tonic. It aimed at the production of products possessing form value by reason of their physical and chemical properties, and stepping up or increasing the value of those products from the market point of view; in fact, it was a question of the elimination of waste.

In the patent files of the world there were records of some 400 low-temperature carbonisation processes, but only relatively few had passed through the necessary stages of development from the laboratory to the industrial unit. The existence of so many processes suggested ingenuity and resource that could not have been developed by a conception which had no value. The quantity of gas obtained (as shown by the figures of the Fuel Research Board) varied from 2,700 to 4,500 cu. ft. per ton of coal carbonised, and the calorific value was high, varying from 800 to 1,020 B.th.u. per cu. ft. The gas, when scrubbed, could yield up to 1½ gal. of light spirit per ton of coal, and this spirit could be refined, with very little loss, to give an excellent anti-knock spirit of aviation quality. The gas could be used for heating retorts, burned under boilers, used to enrich coal gas, or compressed and stored in special light cylinders for use in lorries. A new technique would have to be developed for the treatment of the primary tar produced.

The semi-coke was undoubtedly the most important product of all. It was a smokeless fuel, it burned well, ignited readily, had a higher rating efficiency than coal, and would go further than coal.

Discussing the use of low-temperature semi-coke as a boiler fuel, Dr. Demouilpied referred to the Dunston power station of the Newcastle-on-Tyne Electric Supply Co., where coal was carbonised and the semi-coke fed on to a chain-grate stoker. Mr. Sloan had stated that they could work out a balance sheet showing a credit balance of nearly 3s. per ton of coal, but he, Dr. Demouilpied, believed that practice would show that Mr. Sloan had been too modest in regard to the value of the semi-coke and gas, for he had fixed it at 76 per cent. of the value of the original coal. His (Dr. Demouilpied's) results with various coals, based on the net calorific values of the coke and gas, and allowing for the heating of the retort, showed values of the order of 82 and 83 per cent.

Comparing semi-coke and coal in the pulverised form, he said that the cost of drying before or during pulverisation was eliminated if semi-coke were used—and the cost of drying coal might be as much as 1s. 4d. per ton. Owing to the physical structure of semi-coke, it offered a greater combustion surface and burned more readily, and with a shorter flame, so that it required a smaller combustion furnace. Semi-coke could be burned satisfactorily with a higher ash content than in the case of coal. The specific gravity of pulverised semi-coke was low, so that the ash had a greater chance of dropping out. Storage was simplified, for the material did not cake, was not liable to spontaneous combustion, and occupied no more space than pulverised coal. Tests had shown that the average rate of steam production was about 21½ per cent. greater than when the parent coal was used, and this would have an important bearing upon the number of boilers required at a station. Tests had also shown that the efficiency of semi-coke was nearly 12 per cent. greater than that of the parent coal from which it was made.

Discussion.

Mr. L. L. ROBINSON (borough electrical engineer, Hackney) said that an investigation of low-temperature carbonisation had damped his ardour severely. Recently he had visited Germany and investigated a process which had been in practical operation at Duisburg for some twelve months. As regarded the production of by-products the process appeared to be admirable, but the calorific value of the gas produced represented only about 10 per cent. of that of the original coal. To use the gas only for boiler firing one would need a good many square miles of plant around the works in order to produce sufficient of the gas. Further, he found that the coal used was sold at about 5 marks per ton, and the semi-coke produced from it was selling at over 25 marks per ton. What had impressed him was that the plant was producing 60 tons of the fuel per day, which was disposed of regularly. Another retort, to produce a further 60 tons per 24 hours, was being erected; it was realised that the coke and the gas were far too valuable to allow of their being burned under boilers.

Mr. E. N. TAYLOR said that if the fuel were prepared in a central plant, an expensive dryer would be required. If, however, one adopted the system of preparing the fuel in a mill on the spot and firing direct, the fuel would be dried in the mill by means of hot waste gas and passed straight to the boiler, and the only loss incurred would be due to the moisture which passed through the boiler and out through the chimney with the waste gas. The cost in that case would be merely the loss in boiler efficiency, probably amounting to about 3 per cent.

Mr. E. F. HALL said that the drying of coal by means of waste gas in a mill, had the disadvantage that very large quantities of gas were required, at a fairly high temperature, and even so the amount of drying was only about 7 or 8 per cent., which was not good enough for slack coals. A system of drying by means of hot air sucked from the bottom of the furnace was being tried, and inasmuch as 1 lb. of air would carry more moisture than 1 lb. of gas, drying to the extent of 11 per cent. could be attained in an air-swept mill.

Mr. R. P. WALLIS said that if the coal were carbonised at the power station, one had the advantage of being able to add the sensible heat from the retort to the boiler furnace, but that system had the disadvantage that both the gas and the coke produced had to be dealt with, and he understood that a totally different type of furnace would be required to burn each of those products.

Mr. E. SMYTHE, referring to the plant at the Dunston power station, said that the operation of the plant had solved a good many problems. A most excellent semi-coke was produced from Northumberland coal and burned direct on the grates of the boilers. Methods of pulverising the coke had been evolved recently, and semi-coke would be burned direct on the grates of the boilers on one side of the boiler house, and the pulverised coke would be burned under pulverised-fuel fired

boilers on the other side. The use of the pulverised fuel seemed to him to solve to a great degree the difficulties in connection with peak load.

Mr. MOUNT pointed out that the bulk density of pulverised coke was very much lower than that of raw coal, and a tank of a given size could transport nearly twice the weight of raw coal as of powdered coke; the importance of this from the point of view of transport costs was obvious. He had heard that two tanks were being manufactured for the transport of powdered coal, so that it appeared that a start was being made in the development of central pulverising plants in this country. The efficiency of coke burning on stokers depended upon air distribution. With regard to the transport of pulverised fuel through pipe lines, he pointed out that the abrasive effect of coals of very low ash content was different from that of coals of high ash content, and one of the biggest problems to be faced in connection with that form of transport was the cost of maintenance of pipe lines. In the burning of powdered coke there would probably be trouble due to the fact that the ash would fall more readily than that of powdered coal, and cause slagging, whereas with pulverised coal the ash would go up the chimney.

Dr. DEMOUILPIED, in reply, said it was stated by Dr. Lander and Dr. Sinnatt (of the Fuel Research Board) in a paper read before the recent World Fuel Conference, that, broadly speaking, it might be assumed that the lump low-temperature coke occupied twice the volume of coal, but that the bulk density of the coke and of coal of a similar degree of fineness would probably be of the same order. The scattering of ash from chimneys over large areas was a serious problem, and he was glad to hear that the ash from the low-temperature product showed a tendency to slag. He believed it would be possible to modify the plant in order to overcome the difficulty Mr. Mount had mentioned.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

New Lighting Fittings.

The accompanying illustrations, figs. 1, 2 and 3, are selections from a range of very attractive modern electric lighting fittings which have recently been introduced by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2. They are constructed of the makers' new "Perlique" form of pressed glassware. Fig. 1 is a 14-light fitting which measures 42 in. in overall length and has a 32-in. spread. It is fitted with flame-coloured panels and the metal-work is finished in gilt or oxidised silver. The fitting shown in fig. 2 is an 8-light pendant and has similar panels and finish. Fig. 3 shows a six-light fitting which is also supplied with gilt or oxidised-silver finish.

Figs. 1, 2, and 3.—"Perlique" Fittings; 14-, 8-, and 6-light, respectively.

Decoration Lamps.

Messrs. PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2, have supplemented their range of candle-shaped Christmas-tree lamps with a handsome set of olive-shaped lamps. These are packed in attractive boxes, designed to lend the correct Yuletide atmosphere to the shop windows in which they are displayed. The lamps are supplied in sets of 9 and 18, one spare being included with the small set (100-130 V), and two with the large set (200-260 V).

A Special Ring-making Machine.

It is claimed that a considerable cheapening of the method of holding in place the cores of induction motors can be obtained by using split rings. The cast-iron housing of the core is slightly tapered to admit the ring, which is then forced down against the laminations and compresses them. A groove is turned in the stator casing, and when the ring comes opposite this it opens out into the groove, thus obviating the necessity for keys. A machine suitable for making rings for this purpose from strip metal on edge has recently been introduced in this country by M.A.X.E.I., 66, Victoria Street, S.W.1. It is capable, it is claimed, of forming rings of from 400-mm. (15¾ in.) to 830-mm. (32¾ in.) outside diameter from cold metal of all sections within the following limits: mild-steel, 60 mm. by 12 mm.; copper, 70 mm. by 15 mm. The machine is mounted on a heavy cast-iron bed carrying worm reduction gearing. It is belt driven, either from a separate electric motor or from line shafting at 1,500 r.p.m., and the driving power required is 6 h.p.

Shaped-conductor Cables.

In a letter circulated by BRITISH INSULATED CABLES, LTD., Prescot, Lancs., is briefly described a method they have patented and adopted for building shaped conductor multi-core cables. The copper conductors are stranded circular in the usual way and pressed into the required shape. Each conductor is then twisted on its own axis, and a lay or twist is imparted to it, which is the same as that which it has in the finished cable. The twisted conductor is then insulated by lapping with insulating paper tapes in the usual manner; the tapes lie naturally on the twisted conductor and form an insulated conductor on which the tapes are smooth. The drums containing the insulated and twisted conductors are then placed in a machine for laying up into a finished cable. The conductors fall naturally into their symmetrical positions in the finished cable.

A Large Induction Regulator.

In the description of the large induction regulator, recently manufactured by Messrs. SWITCHGEAR & COWANS, LTD., in our issue of December 7th, p. 1004, the rotor is referred to as being driven by a 12½-h.p. motor: the figure should read 2½ h.p.

Electrically-operated Sun Blinds.

AUTOMATIC SUN-BLIND CO., LTD., of Kent House, 87, Regent Street, W.1, send us particulars of a new device which they have patented throughout the world and recently put on the market for electrically operating sun-blinds as fitted over shop windows, doors, and so on. The driving unit, consisting of a ¼-h.p. electric motor coupled to a worm reducing gear, is fitted into and enclosed by the blind roller as depicted in fig. 4. The motor is protected from the weather, and its inclusion in the roller does not necessitate additional space in the blind-box. A limit switch automatically stops the blind at the end

of its travel, in or out. The apparatus is controlled by a rotary switch which allows the blind to be raised, lowered or stopped at any intermediate position at will, and the worm gear locks it in that position. It is claimed that existing blinds can be

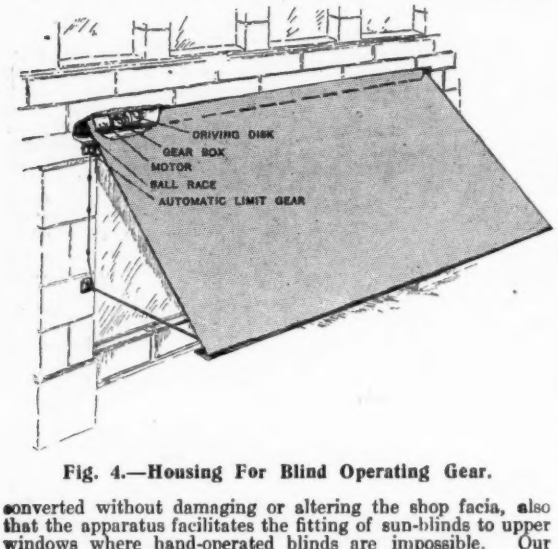


Fig. 4.—Housing For Blind Operating Gear.

converted without damaging or altering the shop facia, also that the apparatus facilitates the fitting of sun-blinds to upper windows where hand-operated blinds are impossible. Our readers are invited to witness a demonstration of the apparatus at the above address.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Faulty Insulation in Bath Rooms.

On December 11th, Sir Mervyn Manningham-Buller asked the Minister of Transport whether his attention had been called to certain recent fatal accidents caused by faulty insulation of electricity in bathrooms, &c., and whether he was issuing regulations or taking other steps as regarded the installation of electrical appliances with a view to avoiding such accidents in future.

Colonel Ashley said he was aware that certain fatal accidents due to the causes mentioned had recently occurred. The wiring arrangements in private houses were not under the control either of his Department or of the Electricity Commissioners, but a code of regulations for the electrical equipment of buildings had been prepared by the Institution of Electrical Engineers.

Electricity for Farms.

On December 11th Sir M. Manningham-Buller asked for the number of farms in England supplied by public undertakers with electricity during the current and past three years, respectively.

Colonel Ashley said he was not able to give the information, but some figures relating to the supply of electricity to farms in rural areas would be found in the recently-published report of the proceedings of the Conference convened by the Electricity Commissioners on electricity supply in rural areas.

Inquiries Regarding Overhead Lines.

On December 11th Sir D. Newton asked the Minister of Transport how many inquiries respecting the erection of overhead transmission lines had been held during the past two years; and the average delay between the date of application, the holding of such inquiries, and the announcement of a decision upon the matter.

Colonel Ashley replied that there had been 75 such inquiries since the beginning of 1927. The average time which had elapsed between the date of the application and of the inquiry was about 5½ weeks, and between the date of the application and of the announcement of his decision, about 17 weeks. It not infrequently happened that at an inquiry both the applicants and some of the objectors expressed their desire that the Minister's decision should be deferred pending further negotiations between the parties, with a view to effecting a settlement.

Tidal Power of the Wash.

On December 11th Sir R. Thomas asked the Minister of Transport whether there had been laid before him any proposal for utilising the tidal power of the Wash, which had tides of from 17 to 25 ft., for the generation of electrical power; whether he had examined the project; and if he would state whether his advisers considered it a practical scheme.

Colonel Ashley said he had seen in the Press some reference to the proposal, but neither he nor the Electricity Commissioners had given it any countenance or approval.

A Standard Wayleave Agreement.

On December 11th, in reply to a question by Sir D. Newton, Colonel Ashley said that he was informed by the Electricity Commissioners that they hoped soon to be in a position to submit a draft form of electricity wayleave agreement to associations representing interested parties.

Wireless in Ships.

On December 11th Mr. Kelly asked the President of the Board of Trade if he would state whether regulations were making it imperative for all ships to have wireless transmitting and receiving apparatus, with at least one qualified operator and a continuous wireless watch, human or efficient automatic; and did this apply to all ships in the lighthouse service.

Sir P. Cunliffe-Lister said the present British law and regulations required all passenger ships and all ships of 1,600 tons gross or more to be provided with wireless apparatus and at least one operator; and if they carried more than 50 persons they must keep a continuous watch. Lighthouse tenders would not be subject to the requirements unless they came within one of those classes.

In reply to Sir C. Kinloch-Cooke, Sir P. Cunliffe-Lister said that he was not aware that any recent disasters at sea had been caused by insufficient wireless apparatus on British ships. The establishment of uniform standards in the matter of wireless on all ships could only be effected by international action, and the question of establishing such international standards would be one of those to be considered by the International Conference on Safety of Life at Sea, which would meet in London in April next.

Horse or Electric Vans?

On December 11th Sir R. Thomas asked the Postmaster-General if he would state the number of horse vans and electric vans, respectively, in use by his department in the Metropolitan area; how the two forms of transport compared in service and cost; and whether, in view of the greater obstruction to other traffic caused by horse vans, it was his intention ultimately to replace them entirely by electric vehicles in London.

Lord Wolmer replied that there were about 270 horse mail vans at present in use under contract in the London postal area. No electric vans were as yet in service, but seven would shortly be brought into use experimentally on services at present performed by foot postmen. Until the result of the experiment was known, he was unable to make any statement with regard to future policy.

The Wessex Electricity Scheme.

On December 12th Major Glyn asked the Minister of Transport if he would state what progress had been made with the Wessex electricity supply scheme; how much labour was being employed in the construction of the grid power lines in that area at the present time; and whether it was now possible to purchase from the Stationery Office a map of Great Britain indicating the proposed main and subsidiary lines constructed, in course of construction, or projected which had been approved by the Electricity Board.

Colonel Ashley said he was not clear as to what precise scheme the first part of the question referred. A portion of the authorised area of the Wessex Electricity Company was included within the scope of the South-East England Electricity Scheme which was adopted by the Central Electricity Board last February. The schemes adopted by the Central Electricity Board under the Act of 1926 had been published by the Stationery Office with maps showing the main transmission lines provided for under the schemes.

The Electricity (Supply) Bill.

On December 13th, in the House of Lords, the Committee stage was taken of the Electricity (Supply) Bill, which amends Section 16 of the Electricity (Supply) Act, 1919, relating to compensation to displaced employés.

Lord Gainford moved an amendment to provide that the compensation should be limited to the period ended December 15th, 1926. He said that the proposal in the Bill was unprecedented in legislation. If the amendment were accepted it would secure compensation for disturbance to all workmen employed up to the time of the passing of the last Electricity Act of 1926. Under the law as it stood they could only get compensation until 1918. The electricity companies had not been consulted about this heavy burden which was to be placed on their industry.

Lord Russell pointed out that the principle of compensation was admitted in 1919, and the propriety of extending it to subsequent entrants was again admitted in 1926. The object of the Bill was merely to remove a practical difficulty which had been found to exist under the Act of 1926.

Lord Londonderry, the First Commissioner of Works, agreed with Lord Russell. Experience, he said, had shown that operations under the Act of 1919 still continued, and that any fears that an alteration in respect of title to compensation would hamper the development of the industry appeared to be exaggerated, and, indeed, unfounded. While the Government had not thought it necessary to introduce amending legislation, it saw no ground for objecting to the proposals of the Bill.

The amendment was rejected, and the Bill passed through Committee without amendment.

The Birth of the Carbon Lamp.

An account of the circumstances attending the invention of the incandescent lamp, 50 years ago.

THE possibility of rendering a loop of wire incandescent by passing a current of electricity through it was, of course, one of the earliest discoveries in electrical science; when the "electric light" with carbon arcs was invented and had attained to recognition as a practicable and efficient system of lighting on the large scale, the question of "sub-dividing the electric light" acquired absorbing interest, and innumerable inventors applied themselves to the problem, all sorts of devices being evolved, in many of which carbon rods raised to incandescence were employed. But the incandescent wire attracted most attention, and the necessity of using a material of high specific resistance was recognised. Unfortunately platinum, and alloys of platinum with other metals of high melting point, had to be run too near that temperature for safety, and were very liable, therefore, to burn out. Thin strips of carbon did not melt, but were rapidly oxidised, and although the idea of enclosing them *in vacuo* was understood, it was not then possible either to produce carbon "wire" or to obtain a satisfactorily high vacuum.

In 1845 J. W. Starr, an American, patented an apparatus employing metallic and carbon conductors *in vacuo*, and Joseph Swan, a native of Sunderland, having witnessed a demonstration of electric light with incandescent platino-iridium wire, saw in Starr's specification the germ of success. He began experimenting, and by 1855 he had succeeded in producing thin strips and spirals of carbonised paper—a novel invention at that time. However, his main occupation was the development of photographic processes, and it was not until 1877 that he resumed his experiments in earnest.

The researches of Mr. (afterwards Sir William) Crookes in 1875 with high vacua produced by the Sprengel pump had shown that the evacuation of glass bulbs was no longer an obstacle. Swan obtained the assistance of C. H. Stearn, an expert in high vacua, and they mounted his carbon strips in exhausted bulbs, but found difficulty in making effective connection with the "films" of carbon; hence carbon wires, made of plastic material and baked, were tried, fitted into platinum sockets. It was then found that after exhausting the bulbs, when the "wires" were heated much gas was given off, spoiling the vacuum. A most important invention followed—namely, heating the carbon wire by passing a current through it whilst the exhaustion of the bulb was being continued. This fundamental process was devised in 1878, and the Swan lamp was successfully made and exhibited at Newcastle-upon-Tyne in December of that year—exactly 50 years ago.

Swan proceeded to develop the manufacture of filaments of cotton yarn treated with sulphuric acid, which he called "parchmentised thread," and which when carbonised were strong, elastic, and homogeneous; later (in 1883) he invented the squirted nitro-cellulose process, and he invented many other improvements in the carbon lamp. Unfortunately he did not believe that the use of a carbon conductor in an evacuated globe was patentable, owing to previous knowledge, and it was not until January, 1880, that he patented his process of evacuation whilst the carbon was incandescent, and the manufacture of parchmentised thread.

In the United States, Mr. T. A. Edison had been busily engaged in experimental work, and from time to time during 1877 and 1878 he issued glowing statements with regard to his successes; but he was working on lamps of the old incandescent rod type, or on lamps with filaments of platino-iridium, &c., all of which proved failures. The TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW of December 15th, 1878, p. 496, reports that "Mr. Edison authorises the statement that his light is produced by the incandescence of an alloy of platinum and iridium. . . . A simple adjustable apparatus attached to each lamp regulates the amount of electricity it shall draw from the main current, and makes it entirely independent of any changes in the strength of the current as well as of all other lamps in the circuit. . . . The details are still a secret." Numerous other references to the subject appeared in our pages in 1878 and 1879, including abstracts of Edison's patents for an "electric candle" (May 15th, 1879), and for lamps of platinum or other metals or alloys (July 15th, 1879). It was not until November 20th, 1879, that Edison obtained a British patent for an electric lamp with a carbon filament in an exhausted glass bulb, and no Edison lamps were exhibited in this country until February, 1880. In that year he patented the bamboo fibre filament.

Eventually Edison and Swan joined hands, and commenced the manufacture of lamps on Swan's processes, but under the broad Edison patent of November, 1879. A full account of the whole circumstances was printed in the ELECTRICAL REVIEW of May 9th, 1924, pp. 742-3.

Mr. J. Swinburne, F.R.S., was to deliver a short lecture on Sir Joseph Swan's work at the Institution of Electrical Engineers yesterday prior to the ordinary meeting.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Earth or Insulate?

I was delighted to see the reply by Mr. Crowdy to my inquiry regarding the Northcliffe House installation, but I think it is distinctly unfair of him to keep his dark and dreadful secret to himself, and not let us in on how it is done. If he could only realise how we poor provincials sit at the feet of the Gamaliels and devour every detail of their super-installations, he would, I am sure, relent a little, and let us know about this small piece of flex.

He does not deny that it *is* flex, which is what I asked somebody to do in my previous letter. I am writing further in the hope that he will take us a little farther, as I feel at the moment in the position of the little boy who has asked his teacher an awkward question and has been told to run away and play.

If a camera can give an electrical engineer a halo I admit it can do anything, but may I point out to Mr. Crowdy that not only can photographs be misleading but words themselves can be the veriest humbugs?

T. C. Gilbert.

Folkestone, *December 15th*, 1928.

Radio Battery Eliminators.

I have been interested in the article under the above title appearing in your issue of November 30th, and also in the correspondence arising out of this article which has appeared in your issue of December 14th.

It may interest your readers to know that a committee of this Association is at present engaged in the standardisation of main supply units for operation from alternating-current systems. Our committee fully realises the dangers accompanying the use of main supply apparatus for direct-current systems, and in view of this it has been decided to standardise a.c. equipment only, at any rate for the time being.

The discussions of the committee relate to the following points:—(1) Classification of types. (2) Method of rating. (3) Standardised ratings for electrical characteristics. (4) Construction of cases. (5) Protection of live parts. (6) External connections. (7) Isolation from mains. (8) Insulation resistance. (9) Component parts. (10) Marking.

J. F. Stanley.
For the Electrical Section,
BRITISH ENGINEERING STANDARDS ASSOCIATION.

London, *December 15th*, 1928.

Electricity in the Foundry.

The concluding paragraph of your leaderette on "Electricity in the Foundry" (page 923 of your November 30th issue) contains a strong indictment in the following terms:—

"Why this method is not more readily adopted by a considerable proportion of the 3,000 grey iron foundries is because foundrymen know all about cupola operation and its comparatively high efficiency; and, apart from the question of fuel charges, they are afraid to adopt electric melting because of the fear that the change will interfere, even temporarily, with the output of the foundry."

This is not true, nor is it fair to the modern enlightened foundryman. A review of the position shows that about three-fourths of the country's production of grey-iron castings consists of gas, water, and soil pipes (made very cheaply and efficiently by the centrifugal process), railway chairs, rain-water and hot-water goods, stove plate, and light castings for the electrical, textile, and agricultural trades. In every one of these trades great strength of the metal, although desirable, is only of secondary importance, cost being the first consideration. The refined and superheated metal from the electric furnace would, in fact, be less desirable than cupola-metal, and would have a very destructive effect on the mould facings and sand, thus rendering impossible the smooth finish so desirable in these castings and, incidentally, costing more to "fettle" the work ready for the subsequent enamelling, &c.

To melt a ton of iron the cupola consumes about 2 or 3 cwt. of coke, which (at 38s. to £2 per ton) equals, say, 5s. per ton of metal, whereas the electric furnace consumes from 600 to 900 kWh per ton, which (at 1d. per kWh) equals, say, £3. The operating cost and upkeep of the electric furnace are much higher than those of the cupola, and add a further £3 10s. to £4 per ton. The final castings are, therefore, likely to cost the engineer about £7 per ton more than at present, an increase of at least about 33⅓ per cent.

One must not forget the axiom that it is not always the best material that the engineer wants, but rather the material which satisfies service demands at the lowest cost. I doubt if there is any other industry in which competition is carried to such cut-throat limits as in the foundry trade, and in this connection engineers' buyers are not altogether blameless. In face of the latter's attitude, what hope has the foundryman of persuading him to pay the increased cost of the electric furnace product?

With regard to the remaining one-fourth of the country's production, represented mainly by the motor trade's castings, Diesel and other engines, and similar high-duty work, there is a possible field of utility for the electric furnace, but it must be borne in mind that competition is very keen even in this field.

The tensile and transverse strengths mentioned, coupled with great resistance to impact, are not the monopoly of the electric-furnace product. They can be (and are being) equalled and even excelled regularly by cupola-melted, high-grade, semi-steels at a lower price.

In America, where electricity generally is cheap, as against dear transport charges for long-distance haulage of coke (conditions which are reversed in Great Britain) the electric furnace has consequently been developed considerably; but, to quote the American Electrochemical Society's round-table conference (a discussion devoted to the comparative merits of electric and fuel-fired furnaces): "It was emphasised that the electric furnace is not a competitor of the cupola *for grey iron;* but where quality governs, the electric unit is *recommended*." (The italics are mine.)

The Electrochemical Society, by the way, includes in its membership practically all the makers of electric furnaces in the United States.

In conclusion, I would say that, far from being afraid to adopt the electric furnace "because of the fear that the change will interfere with the output of the foundry" and (by your writer's implication) interfere also with his somnolent routine, the modern ironfounder, particularly those attached to the big electrical companies, will welcome the electric furnace just as he has already welcomed the installation of ultra-rapid moulding machines and other foundry labour-saving devices, be they electrical or otherwise. Electricity and electric-furnace costs will, however, have to be reduced considerably, or else the castings buyer must be persuaded to slacken his purse strings before "canny" foundrymen will adopt the electric furnace as a supplanter of the cupola.

Jas. A. Reynolds
(One of the 3,000).

Prescot, *December 7th*, 1928.

Electrical Trade with Russia?

Your interesting leader on the above subject (Elec. Rev., December 7th), though somewhat belated, should receive the attention of every electrical engineer who is not prepared to accept his information concerning Russia from the daily Press with its natural prejudices and sensationalisms, or from biased politicians with highly gifted imaginations. Whether conditions in Russia are chaotic or not, one is apt to forget that our own industries, such as coal and agriculture, are in such a pathetic state that our Government is utterly impotent to deal with the problem of unemployment resulting therefrom. All that we are offered are "safeguarding," derating, and other political "stunts" which cannot possibly be regarded as a solution.

The point is that Russia is sufficiently stable to be in a position to place substantial orders for electrical and other goods, and, whilst we are looking on, other countries, such as America, Germany, Sweden, and Czecho-Slovakia are taking advantage of an important export market, and, one may rest assured, will consolidate the position once an entry has been gained. This, at a time when exports are so vital to Great Britain, when it is so essential to explore every possible field to keep our factories fully occupied, savours of industrial suicide.

What is the use of talking about "evasion of past responsibilities" when other countries are evading their responsibilities? In any case, this has nothing whatever to do with the flow of trade. Such matters can only, and must, inevitably, be settled at a round-table conference, just as we are dealing (ten years after the war!) with German reparations. Treating Russia as an Ishmael amongst nations obviously does not bring a settlement of the matter any nearer.

It is quite probable that our attitude towards Russia may change in the near future, but in the meantime a valuable market may have been lost.

I may say that I am an Englishman without any commercial interest whatever in Russia, but as an engineer and business man I am utterly at a loss to understand our manufacturers whose welfare our Government is supposed to represent.

"Pax."

December 13th, 1928.

Hydro-electric Systems in New Zealand.

On page 964 of your current issue you mention statistics relating to the operation of hydro-electric schemes in New Zealand. There appears to be a serious discrepancy, however, in the figures, which I have abstracted and re-arranged as under:—

System.	Total revenue.	Total units sold.	Average receipts per unit.
Lake Coleridge ...	£71,127	93,853,759	0.181d.
Waikato	£125,312	87,852,067	0.342d.
Mangahao ...	£44,112	97,786,572	0.108d.

The average receipts per unit sold are so abnormally low that I am inclined to believe there must be an error somewhere in the returns. If so, would you kindly state the correct figure? I think it would be of interest, also, if you could mention how many years each of these undertakings has been in operation, up to and including the financial year in respect of which the records in question are given.

P. A. Spalding.

Dundalk, *December 10th*, 1928.

[We are indebted to our correspondent for drawing attention to the figures in question. In the case of Lake Coleridge, a misprint occurred in the total revenue, which should read £171,127; the energy generated was 93,853,759, and the energy distributed 84,770,718 kWh, the revenue per unit distributed being 0.484d. The working costs amounted to 0.113d., and the capital charges to 0.299d.—total, 0.412d. per kWh. For Waikato the figures are correct; the working costs amounted to 0.111d. and the capital charges to 0.228d.—total, 0.339d. per unit sold. In the case of Mangahao the data are complicated; the figure for energy sold was correct, but the energy generated was only 74,726,880 kWh, owing to shortage of water, and 29,241,229 kWh was purchased from other supply authorities. According to *The Electrical Engineer of Australia and New Zealand*, "The net revenue for the year was £44,112, as against £101,897 last year. The decrease is on account of the large amount, *viz.*, £111,745, paid for power purchased from local undertakings. The working expenses were £33,914, an increase of £6,993 over those for last year." Interest amounted to £106,441, depreciation to £35,301, and there was a loss of £131,544. Our contemporary states that the revenue per unit sold was (as inferred by Mr. Spalding) 0.108d.; the working costs amounted to 0.084d., and the capital charges to 0.35d., a total of 0.434d. per kWh. It will be seen that these figures have been based upon the aggregate energy sold, including that purchased and resold. In the previous year there was a loss of £56,902.

The Lake Coleridge plant has been at work for 13 years, and Mangahao four years; the Waikato undertaking has several sources of supply, of different dates.—Eds. Elec. Rev.]

Lincolnshire Electrification.

Your correspondent "Lindsey" cannot be congratulated upon the matter or manner of his criticism of Dr. Ekström.

We have his statement: "Perhaps Dr. Ekström, who admitted his ignorance of our Regulations, is unaware of the *fact* that he cannot erect e.h.p. lines along public roadways." This is neither accurate nor polite. It is, in fact, the reverse of the fact! All editions of Overhead Regulations issued by the Commissioners have allowed e.h.p. lines to be erected along public roadways. There are several miles of e.h.p. lines so placed in this (Mid-Cheshire) area.

It is uninformed criticism, such as that of "Lindsey," which makes the educational work of the Overhead Lines Association so necessary.

May I take this opportunity of wishing a happy and prosperous New Year to all engaged in rural electrification work, and to those (including the staff of the Electrical Review) who are doing their best, in various ways, to forward that important branch of electrical development.

W. Fennell,
President, Overhead Lines Association.

Northwich, *December 16th*, 1928.

Hot Spots in Transformers.

So far as the controversy between Messrs. Norris and Kennett is concerned, I have refrained from expressing an opinion on a subject which is of particular interest to me; but since reading "Designer's" communication in the current issue of the Electrical Review, I am constrained, in fairness to Mr. Norris, to enter the arena.

Incidentally, the whole trouble arose through the lamentably loose wording of Mr. Kennett's anti-hot-spot advertisement. To anybody knowing the fundamental laws of the thermal design of a transformer, his assertion that the hottest oil temperature is a reliable guide to the safe loading of a transformer (of Hackbridge or any other manufacture) is ludicrous in the extreme.

To return to "Designer," who states that, in order to check Mr. Norris's figures, he has calculated the continuous overloads necessary on some 250-kVA transformers to raise the oil temperature to 90 deg. C. with an air temperature of 15 deg. C., an examination of Mr. Norris's statement shows that he assumed that the transformer in his example was supplying "a typical residential load"; that is to say, the maximum demand on the transformer was for four or five hours. Clearly, then, even "Designer's" unreliable figures of 1,000 kVA or more for a short period, and 315 kVA continuously, support Mr. Norris's figures of 400-600 kVA for a typical residential load. In making his calculation "Designer" makes assumptions regarding the average temperature of the windings which are not only erroneous, but also quite unnecessary, as is well known to every transformer designer worth his salt. The temperature rise of the oil is quite independent of the winding gradients, and is approximately proportional to the total losses (these will, of course, depend on the ratio of iron to copper loss for the transformer under consideration).

When it is realised that in a transformer of bad thermal design the maximum temperature rise of the windings of a transformer may be as much as 30 deg. C. higher than the temperature rise as measured by resistance and still conform in every way to the B.E.S.A. Specification, it will be appreciated how necessary is a maximum winding temperature indicator.

Progress is proverbially slow in this country, but the time will inevitably come (as is already the case in America) when loading transformers on a thermal basis is legislated for by the B.E.S.A., and temperature indicators in one form or another will be fitted to transformers as frequently as oil thermometers are to-day.

Transformer Designer.

December 10th, 1928.

Two letters on this subject appear in your last issue, and before dealing with them I will make some elucidatory remarks. In the first place, Mr. Norris has all along assumed that the advertisement of the Hackbridge Co. criticised an article which he had written, also that it used the words "hot spots" mysteriously in other than their every-day meaning. The assumptions are groundless; in fact, I have not so much as seen his article, and if he had taken the sensible and straightforward course of addressing a direct inquiry to the Hackbridge Co., he would have received a ready and courteous reply on these heads, and would have found them willing to amend the wording if they thought it reflected upon him. Instead, he has taken upon himself the responsibility of rushing into print, basing upon these fallacious assumptions not only an irrelevant criticism of the advertisement, but serious charges of what he thought to be the Hackbridge Co.'s "ignorance" of design—another mistake. From my gentle admonitions, he must have realised that his assumptions were incorrect and should frankly have admitted it. Let us now examine the two letters.

Mr. Norris (and "Southerner") must realise that as the advertisement did not criticise his article, he is out of order in requiring me to substantiate its terms. On the contrary, as he directly criticised the advertisement (October 26th), he is in honour bound to substantiate or withdraw his criticism. He, however, now writes as though no previous letter had appeared, so I direct his particular attention to his letter (October 26th) and the last two paragraphs of my letter (December 7th). He next makes an attempt to cross-examine me upon the advertisement. Advertisers are entitled to extol the virtues of their products without interference, and if they were to be subject to attack by any self-opinionated persons, the situation would be intolerable. Most advertisements could be criticised by people holding different opinions, but it is a breach of professional custom to do it. How can such a plainly worded advertisement mislead anyone? As my personal opinion, I certainly do discount the general use of indicators and, moreover, the use of transformers which need them. The fallacy now tardily acknowledged, that Mr. Norris *assumed*, instead of ascertaining, that I used the term "hot spot" and "hottest spot" synonymously, is but a half-hearted admission of the groundlessness upon which he has initiated this controversy. How much more graceful would it have been frankly to apologise for his inexcusable attack instead of trying to continue it. However, it obviously, and satisfactorily so far as I am concerned, ends the matter.

As to "Southerner," he can be quickly dismissed. Anyone who has followed this correspondence can see that he either has not read it, has failed to comprehend it, or is trying to confuse the issues, for his letter has inverted the facts. It needs no reply.

William C. Kennett.

Walton-on-Thames, *December 15th*, 1928.

[This correspondence is now closed.—EDS. ELEC. REV.]

Published Specifications.

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specification will be printed and abridged and all subsequent proceedings will be taken.

1927.

13,409. "Fire-alarm systems and apparatus." L. Mellersh-Jackson (Siemens and Halske Akt. Ges.). May 18th, 1927. (300,927.)

14,223. "Television apparatus." J. L. Baird and Baird Television Development Co., Ltd. May 26th, 1927. (301,097.)

19,736. "Electrical switchgear of the metal-clad type." D. R. Davies and Metropolitan-Vickers Electrical Co., Ltd. July 25th, 1927. (301,101.)

21,374. "Preparation of laminations for transformers and the like." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). August 13th, 1927. (300,930.)

21,902. "Warning devices for electrical appliances." H. R. P. Tolley. August 19th, 1927. (300,937.)

22,261. "Electrical controllers." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). August 24th, 1927. (301,103.)

22,445. "Flexible electric conductors." Callender's Cable and Construction Co., Ltd., P. V. Hunter and H. J. Allcock. Augus 26th, 1927. (301,110.)

22,449. "Solar-ray therapeutic apparatus." K. Sawada. August 26th, 1927. (301,111.)

22,501. "Vibratory magneto devices such, for instance, as are employed in sound-reproducing or sound-recording apparatus." W. E. Clifton and Cliftophone, Ltd. August 26th, 1927. (301,113.)

22,502. "Electric amplifying circuits containing electron-discharge devices." W. E. Clifton and Cliftophone, Ltd. August 26th, 1927. (301,114.)

22,508. "Telephone systems." J. E. Poliak (Associated Telephone and Telegraph Co.). August 26th, 1927. (301,115.)

22,511. "Radio direction bearing indicators and the like." A. W. Whistlecroft. August 26th, 1927. (301,116.)

22,687. "Fire-alarm systems." Standard Telephones & Cables, Ltd., A. M. Searle, L. P. Lowry, J. R. Gould and E. F. Bates. August 29th, 1927. (301,118.)

22,695. "Luminous advertisements." F. W. Gillard. August 29th, 1927. (Addition to 278,165.) (301,120.)

22,865. "Electrical and wireless testing apparatus." S. T. Hosken. August 31st, 1927. (301,123.)

22,876. "Radiators or cooling devices." E. M. Johnson and Metropolitan-Vickers Electrical Co., Ltd. August 31st, 1927. (301,124.)

23,013. "Arc-welding tools." Imperial Chemical Industries, Ltd., and J. H. Paterson. September 1st, 1927. (301,125.)

23,071. "Electrical apparatus for the transmission of data over long distances." Barr & Stroud, Ltd., and J. W. French. September 2nd, 1927. (301,127.)

23,461. "Tuning and like coupling coils for wireless telegraphy and telephony." J. Macwilliam and E. J. Long. September 6th, 1927. (301,134.)

24,192. "Automatic electric lifts." C. J. Barnett. September 14th, 1927. (301,140.)

24,502. "Manufacture of gasfilled electric incandescent lamps." General Electric Co., Ltd., and F. J. G. Van Den Bosch. September 17th, 1927. (301,143.)

24,857. "Methods of and means for protecting electric distribution circuits." British Thomson-Houston Co., Ltd., and H. S. Holbrook. September 21st, 1927. (301,144.)

25,502. "High frequency induction furnaces." Siemens & Halske Akt. Ges. June 10th, 1927. (291,774.)

26,346. "Pick-up devices for use with gramophones and the like." H. Andrewes and Dubilier Condenser Co. (1925), Ltd. October 5th, 1927. (Addition to 285,315.) (301,158.)

27,035. "Terminal assemblies for telephone exchanges." Siemens Bros. and Co., Ltd., and C. Lambert. October 12th, 1927. (Addition to 270,834.) (301,163).

28,413. "Accumulators." E. S. Elliott. October 26th, 1927. (301,173.)

28,661. "X-ray system." F. S. Smith. October 27th, 1927. (301,174.)

29,960. "Incandescent cathode rectifiers." F. Meyer and H. J. Spanner. November 15th, 1926. (Addition to 276,303.) (280,550.)

30,676. "Automatic and semi-automatic telephone systems." Siemens Bros. and Co., Ltd., and C. L. Peters. November 15th, 1927. (301,190.)

33,841. "Suspension device for overhead conducting wires for electric railways." F. Berg. December 14th, 1927. (301,216.)

34,496. "Electrodes for electric welding or soldering." Alloy Welding Processes, Ltd., and E. J. Clarke. December 20th, 1927. (301,221.)

1928.

154. "Apparatus for electrically reproducing from phonograph disks." J. Dieux. January 3rd, 1928. (301,227.)

481. "Cooling tanks for electric machines." British Thomson-Houston Co., Ltd. January 7th, 1927. (283,218.)

493. "Installations comprising an amplifier or wireless telegraph apparatus and any source of vibrated or modulated electric current, such as an electric phonograph disk reproducer." J. Dieux. January 6th, 1928. (301,229.)

1,797. "Furnace regulation." British Thomson-Houston Co., Ltd. January 19th, 1927. (283,903.)

2,072. "Regulating devices for arc lamps." C. Zeiss (firm of). February 14th, 1927. (285,366.)

2,077. "Cabinets applicable for wireless receiving sets." T. O'Brien, Ltd., and A. J. Fowler. January 20rd, 1928. (301,336.)

2,922. "Electric lamps." T. Ohara, K. Enomoto and K. Honda. January 30th, 1928. (301,240.)

3,474. "Electrolytic production of light metals." P. L. Hulin. February 3rd, 1927. (284,678.)

4,241. "Mounting and manipulating electric lights for automobiles." J. H. R. Webber February 16th, 1928. (301,248.)

4,486. "Temperature regulating device for electrical heating apparatus." Dr. W. Stuwe. February 13th, 1928. (301,250.)

4,545. "Electron-discharge devices." Westinghouse Electric and Manufacturing Co. February 21st, 1927. (285,810.)

6,713. "Distributers for electrical ignition devices." R. Bosch Akt. Ges. March 12th, 1927. (287,049.)

7,105. "Methods of and apparatus for mounting filaments of thermionic devices." British Thomson-Houston Co., Ltd. March 11th, 1927. (286,792.)

8,504. "Devices for preventing the glare from electric lamps." O. A. Townsend. March 20th, 1928. (301,259.)

10,297. "Electric switches." Metropolitan-Vickers Electrical Co., Ltd. April 9th, 1927. (288,315.)

10,310. "Operation of metal vapour lamps by means of alternating current." A. Jaenicke. May 11th, 1927. (290,244.)

10,745. "Electric switches." C. W. Dingertz. April 30th, 1927. (289,771.)

11,888. "Electric impact fuses for projectiles." Rheinische Metallwaaren- und Maschinenfabrik. April 27th, 1927. (Addition to 273,338.) (289,436.)

12,929. "Oil switches with extinguishing chambers." International General Electric Co., Inc. May 2nd, 1927. (289,820.)

14,422. "Lighting apparatus." W. A. Dorey. January 24th, 1928. (301,281.)

16,903. "Iron core with squirrel-cage type of winding for electrical machines." Siemens Schuckertwerke Akt. Ges. June 28th, 1927. (292,977.)

17,420. "Train-dispatching systems." General Railway Signal Co. June 16th, 1927. (292 169.)

18,359. "Electrical controlling devices." Metropolitan-Vickers Electrical Co., Ltd. June 25th, 1927. (292,923.)

19,041. "Grid controls for thermionic electric valves." R. Kapp. August 29th, 1927. (Divided application on 276,695.) (Addition to 276,695.) (301,280.)

19,422. "Wire-spiralling machines." General Electric Co., Ltd. July 20th, 1927. (294,206.)

19,536. "Heat-exchange apparatus." Akt. Ges. Brown, Boveri et Cie. November 14th, 1927. (300,543.)

20,348. "Heterodyne radio receiving systems, and apparatus for use therein." H. J. M. de Regnault de Belleseize. July 13th, 1927. (293,839.)

20,639. "Tubes, more particularly for surface heat-exchange apparatus." Akt. Ges. Brown, Boveri et Cie. April 14th, 1928. (301,291.)

28,354. "Multiple thermionic valve for use with apparatus for connections to the mains." Dr. S. Loewe. July 10th. 1926. (Addition to 293,858 and 297,712.) (Divided application on 19,132/27.) (298,136.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from December 12th :—

Kymore. No. 495,331. Class 5. Wire for electric transmission lines.—Kymore Syndicate, Ltd., Balfour House, Finsbury Pavement, E.C.2.

Leciton. No. 491,235. Class 8. Cables for electrical purposes. No. 491,236. Class 40. Wire covered with a composition of india-rubber and bitumen in which india-rubber predominates. No. 491,237. Class 50. Wire covered with a composition of india-rubber and bitumen in which bitumen predominates.—Liverpool Electric Cable Co., Ltd., Linacre Lane, Bootle, Liverpool.

Trafcand. No. 494,606. Class 8. Apparatus for use in connection with radio-telephony.—A. T. Snell, trading as the Junction Engineering Co., 146, Duke's Avenue, Muswell Hill, N.10.

Clarith. No. 495,896. All goods in Class 8.—Clarith Reproducers, 3, Queen Square, Leeds.

Lux. No. 493,880. All goods in Class 18.—Electrolux, Ltd., 153-155, Regent Street, W.1.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ASHTON-UNDER-LYNE.—Re-erection of portion of works, Oldham Road, Bardsley, for the Bardsley Wadding Co.

AYLESBURY.—Tramp wards (£8,688), for the Board of Guardians; Cannon, Green & Co., Ltd., builders.

AYR.—Shops and hall (£7,500), Boswell Park, for James Gilchrist, Ltd.

BARNSLEY.—Church, Lundwood, for the Wesleyan trustees; W. T. Turner, Westville Road. School, Littleworth Lane; Education Committee.

BIRKENHEAD.—Cinema (£50,000), for Andrew Boyd.

BIRMINGHAM.—Municipal aerodrome; city engineer.

BLACKBURN.—Senior school (£18,600), for the borough E.C.; education architect.

BLACKPOOL.—Hospital; board of management. Extension of sanatorium (£9,830); borough engineer.

BRADFORD.—240 houses, White Abbey area; W. J. and R. Turnbull, Leeds. Market extensions; city architect.

BRETTEL LANE (BRIERLEY HILL).—Two schools, for Staffs. E.C.; F. A. Hughes, director of education, Stafford (returnable deposit of £8 8s.).

BRIGHTON.—Film studios, Whitehawk Bottom; British Film Corporation. Admission hospital, mental institution, Beechmont estate; medical officer. 56 houses, Whitehawk estate; borough engineer.

BRISTOL.—26 houses, Portway estate; E. R. Dyke.

BROADSTAIRS.—Roman Catholic church, Edge End Road (£15,000); Sir Giles Gilbert Scott, architect.

BROCKMOOR.—School, for Staffs. E.C.; F. A. Hughes, director of education, Stafford (returnable deposit of £4 4s.).

BURSLEM.—Additions, New Wharf Pottery; Wood & Sons. Additions, Sneyd Pottery, Albert Street; Smith and Owen. Additions, mills, Federation Road; Burslem Mills, Ltd.

BURTON LATIMER.—Re-erection of boot factory, Rosebery Street, for J. Eady & Son, Ltd.

CARLISLE.—300 houses, Botcherby, Longsowerby, and Newtown estates; city engineer.

COVENTRY.—Hall (£10,000), for the Salvation Army. Factory, Oldchurch Road, for Courtaulds, Ltd., silk manufacturers, London.

DARTFORD.—Office extensions, for the Board of Guardians; G. E. Burgess, architect, Station Approach (returnable deposit of £2 2s.).

DERBY.—Housing scheme (402), for the T.C.; C. A. Clews, borough surveyor (returnable deposit of £1 1s.).

DEWSBURY.—Central offices and motor garage, for the Yorkshire (W.D.) Electric Tramways, Ltd.

DONCASTER.—Proposed boys' and girls' central schools (700 places); director of education.

DORCHESTER. — Alterations, Municipal Offices, North Square; borough engineer.

DOVER.—Cinema, Castle Street (£60,000), for the British Gaumont Co.; C. Masey, architect, Devereux Court, Strand, London.

DUNTON GREEN (SEVENOAKS).—Factory for Vitreo-Colloid, Ltd.

EAST GRINSTEAD.—Bazaar premises, London Road, for F. W. Woolworth & Co., Ltd., Kingsway, London.

ECCLES (MANCHESTER).—Post office and telephone exchange, Church Street, for H.M. Office of Works, King Charles Street, London, S.W.

FILEY.—Additional 72 houses, for the U.D.C.; surveyor.

FOLKESTONE.—Re-erection of Savoy Theatre, for A. O'Connor.

GLASGOW.—Further extensions, Bellefield Sanatorium (£44,000); medical officer. Single-storey goods shed, Berth No. 6, Broomlielaw Quay (deposit £2 2s.), for Clyde Navigation Trust; A. M. Fulton, chief assistant engineer.

GRIMSBY.—Tuberculosis hospital (£20,845), for the T.C.; borough surveyor.

HALIFAX.—Central stores, for the Industrial Co-operative Society, Ltd.; Clement, Williams & Co., architects, Commercial Street. Houses (120), Club Lane and Cousin Lane, for J. H. Naylor & Son and Miss Inez May Hellliwell.

HANLEY.—Additions, works, Brunswick Street; Boyce, Adams & Co.

HAYWARDS HEATH.—Extensions, Mental Hospital, for Brighton T.C.; borough surveyor.

HULL.—Landing stage, &c.; city engineer.

KENDAL.—Re-erection of sawmills, Beezon Lane, for A. Pattinson.

LONDON (E.C.).—Rebuilding 135-141, Fleet Street; Daily Telegraph and Allied Newspapers, Ltd.

(STEPNEY, E.).—Tenements, Holland estate (£29,500); A. T. Rowley, Tottenham.

(N.W.).—Wards at North-Western Hospital, for Metropolitan Asylums Board; Paine & Hobday, architects.

(DOWNHAM, S.E.).—British Legion club and concert hall (£4,000); H. Parker & Co., architects, Cheapside, E.C.

(LEWISHAM, S.E.).—Adaptation All Saints' orphanage for extensions Colfe Grammar School (£11,500); governors.

(PECKHAM, S.E.).—Reconstruction, Hollydale Road elementary school (£19,000); L.C.C. Education Committee.

(ST. MARYLEBONE, W.).—Shops and flats, Marble Arch and Great Cumberland Place; F. J. Wills. Additions, 466-490, Edgware Road; O'Donoghue & Halfhide.

LONGTON (STAFFS.).—Additions, works, Albion Street; Royal Albion China Co. 28 houses, Uttoxeter Road; F. Lord.

MANSFIELD.—Additional 47 houses, Ravensdale estate, for the T.C.; borough surveyor.

MEADOWFIELD (Co. DURHAM).—Church and schools, for the Primitive Methodist trustees; T. W. T. Richardson, architect, 57, High Street, Stockton-on-Tees.

NORTHALLERTON.—Linoleum factory, for Miles Sykes, Sowerby Bridge.

OXFORD.—Hostel for undergraduates, New Inn, Hall Street; Rev. P. E. Warrington.

PLYMOUTH.—Library, North Prospect (£11,640); city architect. Paint factory, Elliott Road; Newton and Andrewatra.

PORTSMOUTH. — Elementary school, Portsdown Hill (£8,556); S. Salter. 216 houses, Hilsea; city engineer. Congregational Church, Edinburgh Road; Rev. Davies.

RAMSEY (ISLE OF MAN).—Housing scheme (24), for the T.C.; J. du P. Kay, architect.

RIPLEY.—Roman Catholic church; Parish priest.

ROTHERHAM.—Aerodrome, Brinsworth; Corporation and Air Ministry. Warehouse, Sheffield Road, Steel Supply Co., Ltd.

ROWLEY REGIS.—Additional 250 houses, Church Farm estate, for the U.D.C.; surveyor.

SALFORD.—Extensions, Ladywell Sanatorium; medical officer.

SPENBOROUGH.—Extensions to wire works, Liversedge, for J. Rigby & Sons, Ltd., and Exchange Street, Cleckheaton, for C. Hirst & Sons, Ltd.

STOKE-ON-TRENT.—30 houses, Henley Road; Shenton Bros.

SUNDERLAND.—Church, Millfield (£15,000); Hicks and Charlewood, architects, Newcastle.

SWANSCOMBE.—Stores; Empire Paper Mills.

TEDDINGTON.—Cinema, High Street; particulars from Harris, Chetham & Cohen, 6, Stratford Place, W.1.

TORQUAY.—Houses (32), Dower House Estate, for T. Vanstone & Sons.

TUNSTALL.—Additions, Pinnox Tile Works, Scotia Road; Henry Richards Tile Co., Ltd. Additions, Brownhills Tileries; Daniel Platt & Sons.

WAKEFIELD.—48 houses, Thornes estate; city architect.

WHITBY. — Extensions, electricity showrooms, for the U.D.C.; J. R. Seward, surveyor (returnable deposit of £2 2s.).

WOLVERHAMPTON.—Schools, for the borough E.C.; director of education.

WORKINGTON.—School, High Street; director of education. Maternity centre (£2,968), for the T.C.; borough surveyor.